The meaning of the word “sustainability” has become greatly extended and distorted. The first section of this book, “RISE AND FALL OF THE CONCEPT SUSTAINABILITY”, examines why this happened and what is its correct meaning. The “three legs” approach is rejected. Sustainability is discussed on different levels—global, national, local, industrial, and corporate. Environmental policy of the E.U. is also examined, as a level of regional integration. Sustainability requirements in the different industries are surveyed. Emphasis is placed on the difference between environmental protection and sustainability. To understand the evolution of the concept of sustainability in the private sector, it is essential to understand what the concept meant when decisions were being made to move us in this direction. The second section of this book, “IMPROVING THE PATH TOWARD ENVIRONMENTAL SUSTAINABILITY”, discusses what was learned during our efforts toward environmental sustainability. It examines errors made in applying what we have learned. The challenge facing us is examined from several perspectives and prerequisites are proposed for organizations intent on becoming environmentally sustainable.

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Discussing Sustainability

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Foreword

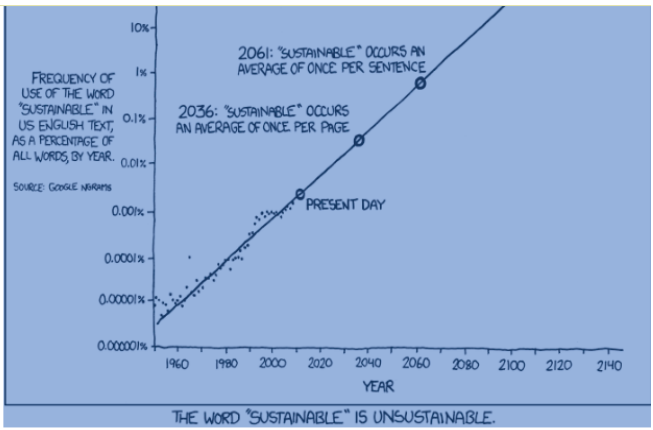
Together with computer, iPhone, globalization, human rights, informatics, gene sequencing, human genome, rich and poor, *environment protection* and *sustainability* also are keywords of our age. Three decades ago the concept of sustainability was perhaps known only by ecologists and environmental economists – but now it is widely used by all professions. What is the reason for this quick upswing of the concept? And what does it really mean? Is it justifiable to spread the concept across all fields of our life? Is sustainability a real goal or a remote idea? Could the economy and industries be sustainable? And if yes, how is that condition achieved?

These issues will be discussed by two scholars. John Morelli was professor of environmental management and technology in the Rochester Institute of Technology, New York, USA, and Károly Kiss was associate professor of environmental economics and policy in the Corvinus University of Budapest, Hungary. Both have spent several decades teaching and studying environmental issues. Professor Morelli's concern is that future designers and providers of our products and services should have an affinity toward, and better understanding of, the natural environment; that their activity should be in harmony with its possibilities and requirements. Professor Kiss did the same for future economists. He was teaching how economic policy could be made environment friendly. Anyhow, the two do not think the same way about the topic. Kiss tends to ignore fixities and bounds of reality and prefers to start from theoretical requirements. He never worked for a firm, he has spent his years in research and teaching. Morelli has more indulgence towards practical necessities, although his position is also firmly based in the fact that human society and economy are part of the global ecosystems and as a result, the former should adopt to the latter. He has worked both in government, cleaning up the environment, and in academia researching and teaching about it. Károly Kiss is a macro-economist, he examines the conditions and structures of the economy and the different industries and contrasts them with an imaginary state if

they complied with the requirements of ecological sustainability. John Morelli is a professional engineer and looks through the eyes of an environmental manager. He examines the process of developing our knowledge and perception about the environment, our behaviour, experience and errors committed in environment protection and what are the social, educational and cultural conditions of heading for sustainability. Professor Kiss has an eye on what should be achieved, Professor Morelli envisages the process and conditions how to get there.

This is why they neither harmonize their approaches nor offer a common view of the topic. They believe that their respective parts complete each other and that their differing perspectives may help the reader to understand the complexity of the issue.

According to this graph, frequency of the word "sustainable" made less than 0,01% in all US English text in 2015. Extrapolating the trend, by the year 2036 "sustainable" occurs an average of once per page. By 2061 there will be no sentence without the word "sustainable".



Source: Google graphics

I do not want to be party-destructive, but it's true:
We squandered our planet's natural treasures,
air and water than if there were no tomorrow,
so no longer will be.
K. Vonnegut

Rise and Fall of the Concept Sustainability

Károly Kiss
Corvinus University of Budapest

ABSTRACT: Sustainability is a key concept when we discuss the effects of human population and activity on nature and the biosphere. Still, especially in Europe, for years it has been used in many other senses both in economics and sociology. Its original meaning has been greatly distorted and extended; it has been misused and abused. This paper examines why this happened and what is the new meaning (if any) of the concept. It also discusses the interpretation of the concept sustainability on different levels—global, national, local, industrial, and corporate—as the author sees it. Environmental policy of the European Union is also examined, as a level of regional integration. Sustainability requirements in the different industries are surveyed. Emphasis is placed on the difference between environmental protection and sustainability.

Introduction: Semantics, misuse, and abuse

Twenty years ago the concept sustainability was known only by ecologists and environmental economists, and its meaning was quite unambiguous: human population and activity should not surpass the carrying capacity of the biosphere, its renewing, resource, and sink capacities.

Nowadays sustainability is one of the mostfrequentlyused words by economists and politicians.You can hardly read a text or aninterview by a leading economist or politician where sustainability is not used several times.By now its original meaning has faded away and been forgotten. It simply means "good," a synonym for everything that is positive.

Source: Stern, Til Mette[1]

One can read and hearabout a sustainable state budget, exchange rate, interest rate, exports, financing, sustainable society, social health, and pension policies. The worst of everything is "sustainable economic growth," which is the oxymoron of economics.[2]

According to environmental economics and ecological economics, permanent economic growth is unsustainable; it is development that can be sustained. The expression has been inflated, overused, misused, and abused. At the same time it crowds out decent adjectives like permanent, steady, balanced, just, continuous, and quick. On the top of everything, the term is used completely unrelated to the natural environment. You cannot object that, still, this is good because an important notion is spreading. To the contrary, as its inflated meaning is spreading, people think that everything is all right we are "sustainable," or at least heading for sustainability.

[1]The Müllers are „ecos". Use the word „sustainable" as much as possible.
[2] Daly 1990, Sustainable Growth: An Impossibility Theorem.

I. Conceptual framing

Mainstream versus ecological economics

Mainstream economics, at least originally, did not have any concern with environmental issues. When economics has been emerged, nobody thought that exhaustion and pollution of the environment may occur. As a result, elements and services of the natural environment have not been priced unlike land, crops, coal, timber, labour, etc. which could become of short supply. In an up to date term, the whole nature was considered as common goods.

On the other side of the spectrum we have *ecological economics*, for which natural environment is the main issue, the No. 1 preference.[3] For this orientation, only that population volume and economic activity are acceptable which do not damage the carrying capacity and renewing ability of nature. Hence we have the authentic definition of sustainability.

In between the two we have *environmental economics*.[4] Environmental economics tries to optimize, to find an optimal solution between economic/social and environmental interests. (In its simplest explanation, the section of the marginal private benefit curve representing the economic/social interests and the marginal environmental cost curve represent the optimum in a Pareto sense that in relation to this point none of the parties' welfare could be improved without compromising the other party's welfare.) Environmental economics has two basic conditions or limits: (a) environmental elements could be monetized (in order to make calculations and comparisons), (b) ecosystem processes are not irreversible (because in case of irreversibility marginal costs tend to the infinity and optimization is not possible).

Herman Daly uses a very good analogy comparing mainstream and ecological economics. A ship stands for the biosphere and loading the ship stands for the human

[3] The most important representatives of this discipline are Herman Daly, Karl Polányi, Kenneth Boulding, Ernest Schumacher, Georgescu Roegen, Robert Constanza, Hans Opschoor, Ludwig von Bertalanffy.
[4] Propably, the most known representatives of this school are Cecil Pigou and David Pearce.

population and economy. The main concern of mainstream economics is maximum load (i. e. growth) of the ship while keeping it in balance (equilibrium economics). But not considering the submerging line (i. e. carrying capacity of the biosphere) of our ship, it will sink due to the excessive load. In contrast to this, ecological economics considers submerging line and it loads the ship only until that possibility.[5]

In the past decades mainstream economics has moved towards environmental economics in the sense that it also implements environmental standards and regulations but not with the aim and result of optimization. As serious signs of irreversibility have appeared in the past decades (mass extinction of species, climate change, desertification, loss of rainforests, etc.), in my view, environmental economics is no longer viable.

The table below compares mainstream and ecological economics adding some other viewpoints: the use of market mechanism, market conformity and relative factor prices:

	mainstream economics	**ecological economics**
environmental sensibility	non	main characteristic
main goals	- growth - stability - optimal allocation of limited resources	- considering carrying capacity of the biosphere - optimal allocation within carrying capacity
using market mechanism	full	to the extent that it does not harm renewing capacity of environmental elements and resources
market conformity	full	full, with the exception of the above limitation
relative factor prices	labour is the most expensive	use of environmental elements and resources should be the most expensive

Using market mechanism and market conformity may need some explanation. In welfare states health, education and social policies are partly taken out from the competency of the market; these are fields of state redistribution. Similarly, only that

[5] Daly, Steady-State Economics, p. 202.

part of the environment should be under market management which is below carrying capacity. I. e., the functioning of the market should be limited.

Another excellent analogy also comes from Daly, referring to the evolution of the economics discipline.[6] He draws a parallel between physical science and economics and asserts that as the Newtonian physics developed to quantum mechanics, such an evolution is taking place in economics: from classic to ecological economics. The details are also worth mentioning. The premises in Newtonian physics were that the atomic world is unfathomably small and the speed of the light cannot be reached. The equivalents in classic economics are: the natural environment cannot be exhausted and does not need to be priced. But at the beginning of the last century scientists penetrated the nucleus, radio waves approached the speed of the light and Heisenberg's uncertainty relation destroyed the determinism of classic physics. Similar changes have been taking places in economics in the past decades: global environmental problems have appeared and irreversibleprocesses started in the biosphere. This should give way to a development, when ecological economics becomes the dominating orientation in the field.

Be it as logical as it is, there are serious obstacles to this change; mainstream economics still rules economic policies and thinking. Firstly, mighty industries are against the change: the oil companies, the car manufacturers, the heavy chemicals producers and the intensive agriculture and food processing are all seriously damaging the environment. They are opposing any policies which are based on reduced environmental load. A recent change in the influence of industries is promising. Fortunately, by now it is not these industries which dominate the stock exchanges but the internet companies of the Silicon Valley: Google, Facebook, Apple, Twitter, Uber, Yahoo, etc. One could not say that they are champions of environmental protection but at least their activity is much less damaging to the environment than those with a material intensive production. (True, neither are

[6]Korten, David: Taking Ecological Economics Seriously. Living Economies Forum, 2011.

without pollution: whenever you print in Google's search machine "climate change" – or any other expression –, and the sources appear on the screen, 7 grams of CO_2 goes into the air due to the servers' electricity use.)[7]

Another obstacle to the takeover of ecological economics lies in our thinking, in our general worldview. It has been formed by the ideas of Enlightenment, the philosophy of Descartes and Newtonian mechanics. It is characterized by a rational and mechanical materialistic, deterministic, simplistic and reductionist thinking. According to this view the world can be understood, processes foreseen and we can dominate the world while we can separate ourselves from other processes. In contrast to this bases of ecological thinking can be found in the Eastern philosophies and Buddhism which are holistic, organic and transcendent. According to them the world is uncertain and uncontrollable, we are part of it and we cannot separate ourselves from other processes. As a result, we should not dominate but accommodate them.[8]

Based on different world views, *metaeconomic problems* of the two orientations are also different, including the subject, the value set, methodology, means and principles and interpreting development. The table below gives a summary of these different approaches.[9]

[7] BBC News 12 January 2009. 'Carbon cost' of Google revealed. According to Alex Wissner-Gross at Harvard University the energy demand of two Google searches equals boiling a tea kettle and every second spent with search emits 0,02 gram CO_2. Google gives much lower data: 0,2 gram CO_2 per search.
[8] László Zsolnai gives detailed information on this topic in his book: Ökológia, gazdaság, etika, 2001. [Ecology, Economics and Ethics], Chapter 2.
[9] Zsolnai László, i.e.

metaeconomic problems	**mainstream economics**	**ecological economics**
Subject	the monetized activities of the society	the full system of economic activities
value set	increasing material consumption	ecologization and humanization
Methodology	positivist	constructive
means and principles	- positive feedback - throughput economy - not considering carrying capacity - anthropocentric thinking	- negative feedback - circular economy (imitating natural cycles) - observing carrying capacity - all living creatures have value on their own (Buddhism and Hinduism)
interpreting development	according to the Pareto principle	- Rawls' principle - Sen's concept

Ecological economics covers all economic activity of the society, not only those which are monetized (e. g. charities, non profit organizations, taking care within the family, home work, etc.). The methodology of mainstream economics is traditionally positivist, following Aristotle. But it should be made clear that value neutrality does not exist in economics. Even basic economic facts, as growth, equilibrium, etc. cannot be deprived of values associated with them. Economic phenomena cannot be treated as dead objects of natural sciences and we cannot disregard from the personal interestedness of the participants and uncertainty being present in all over the economy. With regard to this the methodology of ecological economics is constructive; it considers the whole system of the economy and tries to create new forms of economic management and organization with a view on ecologization and humanization. (An example for this is the revival of traditional farming in flood-basins in Hungary.)

Ecological economics is guided by different means and principles than is the mainstream one. The profit the, interest, expansion and consumption maximization triggers off positive feedbacks. In contrast to this, ecological economics minds that processes should be of negative feedback and economy should imitate nature and circular cycles. Karl Polányi the Hungarian social scientist in his book *The Great Transformation* developed the idea that in industrial societies economy dominates society and nature.[10] But we should go back to the natural arrangement when economy is embedded in society and society is embedded in nature. This needs a change of our values and world view. Mainstream economics emphasises growth as quantitative change while for ecological economics development as qualitative change does matter. Concerning development more particularly, for mainstream the Pareto principle is representing development, namely: there is improvement at least in one field while there is no deterioration in the other fields. For ecological economics development is represented by Rawls' principle: a positive change in the condition of the worst-case factor. But Amartya Sen might be also mentioned here; interpreting welfare as liberty.

Evaluating characteristics of complex systems[11]

In the previous point the notion of sustainability was conceived in a normative way, based on values and world views. But we should approach this notion in a positive way as well, on the basis of system theory.

When we give definitions of sustainability, we discuss an issue which belongs to a theoretical field, namely, the quantitative characterisation of complex systems. The question is how to ensure the long term survival of a given complex system, the components of which are nature and the technosphere. This is the specific case of a general issue. On a higher level of abstraction the question is this:how and how far a general and energetically open complex system is able to sustain itself. "This is the

[10] Polányi: The Great Transformation, 2001.
[11] See Karcagi-Kováts Andrea, Mivel mérjük a fenntarthatóságot? [How to measure sustainability?] 2011, Chapter 2.

generalization of questions like these: what are the conditions of survival of an ecosystem (forest, lake, meadow), a living creature, a town, an industrial plant, a national economy? Why the day-fly lives for one day and the turtle for hundred years? In general, what are the conditions of the life span of a system?"[12]Hence the need for indicators of sustainability comes, which characterize the state and main processes of an energetically open complex system.

Within system theory, one way of analysis is the implementation of theory of complex networks on nature and society. Kertész and Vicsek, two Hungarian physicians suggest neglecting mutual effects and concentrating only on the scheme of the complex system. This helps a better understanding of the core of the problem.[13]

Vilmos Csányi, a Hungarian ethologist, discusses molecular, cellular, organismic, neural, ecological, cultural and technological evolution in one unified model. This approach creates the possibility of discussing sustainability as global ecological problem, that of the biosphere-human society complex system. From the point of view of physics, the bio-social system is an open system with permanent energy flows and therefore a subject to the laws of thermodynamics.[14]

Friedrich von Hayek, in his paper "The Theory of Complex Phenomena", 1961, discusses the issue that what kinds of indicators are necessary for pattern recognition and pattern prediction. This may serve as a general framework for studying indicators, necessary for evaluating sustainability.[15]

István Kuti and Andrea Karcagi-Kováts, representatives of ecological economics, following Malte Faber and colleagues from Heidelberg, create a relation between sustainable development and the general theory of stocks.[16] According to this theory,

[12] I.e., p. 21.
[13] See Kertész and Vicsek in Karcagi-Kováts, p. 20.
[14] I.e., p. 21.
[15] I.e., p. 23.
[16] Karcagi-Kováts Andrea – Kuti István: A készletek általános elmélete és a fenntartható fejlődés. [The general theory of stocks and the sustainable development] Magyar Tudomány, 2012/2. Stock is a

stocks should be preserved in the interchange between nature and society and this is called sustainability. As to me, I would emphasize not so much preserving the stocks but rather preserving the self-regulating and renewing capacity of nature during this intercourse. Besides, there is a basic difference between the two approaches. Thinking in stocks – especially having in mind life conditions – is inevitably static, emphasis is put on their stability. At the same time, the biosphere has a dynamic character.

In my view, the most important characteristic of the bio-socio system must be whether it does serve the self-regulating capacity of its subsystem, nature. As a result, we may define sustainability as creating such conditions which ensure the sane functioning of the self-regulating and renewing capacities of the biosphere.

On this theoretical level the question of notion-formation and measurement also should be addressed. According to the general view, ideation and measurement should go hand in hand in science, gradually complementing each other; a phenomenon could not be properly defined until its measurement is not sufficient. But these criteria refer to the classical sciences where experiments can be repeated at choice. In case of global environmental problems this is not viable. Therefore, we have to apply the so called "precautionary principle": if the occurrence of a critical state is very probable and its consequences might be very serious, we have to manage the case even if the scientific proof is not complete.

generalized concept, in contrast to flow. All resources, including natural, human and social are considered as stocks.

II. The Brundtland definition and the „three legs" approach

The critique of the Brundtland definition

"A development which meets the needs of present generations without compromising the ability of future generations to meet their own needs" (Our Common Future).

The notion of sustainable development has been created with an inborn defect. The second part of the Brundtland definition (without compromising the possibilities of future generations to meet their demands) is all right, but the first part, "to satisfy the needs of the present," is a criterion that cannot be met. Needs cannot be satisfied, partly because above a minimal-level characteristic for the given society they are determined by motivation of social prestige. On the other hand, permanent—and even accelerating—technological development generates newer and newer needs.

This defect can be explained by political considerations. The concepts elaborated by the UN and its institutions are addressed to the whole world, including the developing countries (the number of which is five times more than the developed ones). In a world where the daily income of 1.2 billion people was less than $1 and 2 billion people got less than $2, economic growth and the satisfaction of basic needs are necessary.[17] However, in the developed countries, where the daily income is between $50-100, sustainability should be interpreted in another way.

Moreover, the Brundtland Commission had to take into consideration characteristics of the developed world as well. The West European citizen prefers to select the household waste according to its material and even colour and collects it into different containers with satisfaction, "well, I have made some sacrifice for the environment." However, the political party that wanted to convince the citizen about

[17] Data from 1981. In 2010 1,2 billion people's daily income was below $ 1,25. The Economist June 1st 2013.

the negative side of economic growth, the necessity of consumption reduction, or less motorization would be doomed. As a result, from the political side, the Brundtland definition is understandable, but scientifically it cannot hold.

I am not sure that we have to be happy that the concept of sustainability has been spread this way. The misbelief that sustainability could be maintained even at this level of consumption involves serious negative consequences.[18]

The origins of the "three legs" approach

The damage emanating from the marketing character of and political concession to the Brundtland definition is dwarfed by the concept based on the so-called legs or pillars of sustainability. This approach can be traced back to the Earth Summits of 1992 in Rio and 2002 in Johannesburg.[19] The concept differentiates the ecological, economic, and social dimensions (pillars or components) of sustainability. A common reference to this reads as follows: "sustainability is not reached if the economy performs not properly and if basic social problems are not solved." If the discussion were about economic and social *conditions* of reaching sustainability, I would fully agree. If these "legs" or "pillars" were interpreted that the economy should develop in a local direction based on environment friendly alternatives, decreased consumption, a different way of thinking and living, and a changed attitude toward nature, that would be acceptable. However, I cannot agree when present day economic and social conditions are considered as equal to the ecological side of sustainability.

A quotation from the Johannesburg Summit 2002, referring to the Agenda 21, endorsed by the former Rio Summit, reads as follows: "The Agenda 21 has integrated in one unique political framework the ecological, economic and social

[18]Let us remember the conclusions of the Factor Ten Club, the Carnoules Declaration: In order to reach sustainability without decreasing consumption, a 10 fold efficiency improvement should be needed in the use of energy and resources. (Carnoules, France, 1994, web)
[19]Agenda 21. "Earth Summit" and Johannesburg Summit 2002. "World Summit on Sustainable Development."

concerns."[20] However, this concept is not the same as is meant by the followers of the "three leg approach." The definition of sustainable development by the Summit resolution is the following: "to ensure a balance between economic development, social development and environmental protection as interdependent and mutually reinforcing pillars of sustainable development."[21] According to a frequent interpretation, the equal importance of the three "legs" supposes that a trade-off could be done among them in the sense that economic success of a country may mitigate the damage done to the environment. This concept does not comply with the conditions of the so-called "strong sustainability," which excludes trade-off between manmade and natural capitals. The trade-off is excluded because irreversible changes have been taking place in the biosphere: the damage cannot be replaced or repaired by more manmade capital.

According to Pearce and Atkinson, $Z = S/Y - \Delta_M\ KM/Y - \Delta_N\ KN/Y;$ if $Z \geq 0$, we have the case of weak sustainability, meaning that savings can replace the amortization of manmade and natural capital.
(S: savings, Y: GDP, KM: manmade capital, KN: natural capital.)

For strong sustainability, $\Delta_N\ KN/Y \geq 0$, the natural capital cannot decrease in time.[22]

Besides, it is quite evident that this "three legs approach" by the documents of the Rio and Johannesburg Summits should be related, first of all, to the third world. In a world summit where four fifths of the 200+ countries are poor, underdeveloped states, one rightly argues that in their case economic growth and basic social rights are equally important. However, this argument should not be extended to countries of abundance and consumer societies. When this has been done, and the three "pillars" have been equalized, ecological sustainability sharply lost its importance. The Assistant General Secretary of the UN stated: "Both the environmental activists and representatives of the industry have seen a false trade off between the protection

[20] Johannesburg Summit 2002, p. 6.
[21] Johannesburg Summit Resolution , 2002.
[22] Kerekes 2007, p. 26.

of environment and economic growth. A new way of thinking should be introduced: one, which considers a healthy economy and a healthy environment as interrelating, mutually improving aims."[23]

Another definition from the Johannesburg Summit is in accordance with my thoughts: "Sustainable development aims at improving the life quality of all people of the world, without increasing the usage of natural resources above the carrying capacity of the Earth."[24] Following, it prescribes the integration of three fields of "key importance":

- economic growth and equality,
- protection of natural resources and the environment,
- social progress.

The first aim is "responsible, long-term growth," when no country or community should lag behind. The protection of natural resources and the environment serves the interests of future generations. I cite the requirement of social development: "People, all over the world, need employment, food, education, energy, health service, water and sewage canalization. Besides the satisfaction of these needs the world community has to ensure the acknowledgement of the rich tissue of cultural and social diversity and the rights of the workers and that all members of the society had the right to participate in the determination of the common future."[25]

It is needless to say that all these requirements refer to the third world. It is their case where backwardness, poverty, and deprivation are of high scale. In their case it is evidently justified to integrate ecological, economic, and social targets and the completion of the ecological sustainability with economic growth, equity, basic human needs, services, and rights, but is it justified to project these requirements on the rich countries?

[23] Johannesburg Summit 2002, p. 2.
[24] I.e. p. 4.
[25] I.e.

Conclusion: The "three legs approach" by no means could be interpreted as a trade-off among the ecological, economic, and social "legs". When the documents of the Earth Summit speak about their integration, the aim is to have in mind the serious economic and social backwardness of the four-fifth parts of the world population. It would be hypocrisy to call them on the protection of the natural environment while their basic needs are not met. However, this approach should not be implemented vis-à-vis the developed countries.

Economic and social sustainability – have they any meaning?

From the previous point we could see that – concerning the definition of sustainability – the aim of the UN Earth Summits was the integration of the ecological, economic, and social elements of sustainability. Namely, reference was made to the components of sustainability, but nobody was speaking about economic or social sustainability separately. Most leading politicians and economists are speaking about sustainable economy and sustainable society without any relation to the ecology. By now these two terms have an autonomous and independent existence. Then what is the meaning of a "sustainable economy"? In other words do "sustainable economies" or "sustainable societies" exist in a non-ecological sense?

When the UN documents discuss the economic and social aspects of sustainability, they define simple requirements that are evidently suited to the developing countries. The economy should be stable, dynamic, and competitive, shortly successful, and "healthy." Resource use should be efficient, and resources should be raised for sustainable development. Also in the society, poverty, discrimination, and unemployment should be combated, big income differences narrowed, tolerance prevail, and equal chances available for all.

No one can doubt the rightness and justification of these goals in the traditional sense. Nonetheless, we can challenge whether these goals have any relatedness to ecological sustainability. Besides, nobody could argue that if these goals were not

reached, sustainability could not be achieved. (Again, we should be aware of the fact that these criteria have been prescribed for the third world.)

The "sustainable economy"

In the '60s and '70s Japan and the small Asian tigers had the most dynamic economic growth, and their competitiveness was outstandingly high. Since the'80s, it is China that beats the growth records; in the '90s India also has accelerated growth. Have these countries approached ecological sustainability? To the contrary, they evidently have been departing from it. High economic growth in these countries is partly due to the cruel destruction of the environment (to some extent, Japan is an exception). In case of China we see a process when high growth is made possible by a cruel exploitation of both labour and the natural environment. However, neither of the countries getting into the downward sloping phase of the pollution Kuznets curve has approached sustainability because their per capita energy and resource consumption is permanently growing, although their efficiency indicators are improving. This process of decarbonisation or dematerialization should not be undervalued. But when per capita energy use – and what is even more important – CO_2 emission is growing, no one can speak about even a trend towards sustainability; to the contrary: we are still heading for unsustainability. [26]

Let us state that even if the dematerialization of an economy is favourable, even if its environmental efficiency is improving, it is approaching toward sustainability only if its per capita energy and resource use are diminishing. (There is only one such a country among the developed ones: Germany. The reason is that after reunification the industry of the former GDR collapsed.) In the countries that got

[26] According to the environmental Kuznets curves countries in their initial industrialization period heavily load the environment: the curve for environmental damage rises parallel to the curve of economic growth. At a GDP level of roughly 10.000 dollars per person the environmental damage curve begins to cede. This is due to several reasons: development in technology reduces the energy and material intensity of production and the environmental consciousness of population is increasing. World Development Report 1992, Overview and Chapter 1.

into the downward sloping phase of the Kuznets curve, only the energy and resource efficiency are improving. This is important but not enough for the sustainability.

As a result, the dynamic growth and the improvement of efficiency have nothing to do with sustainability. What about the fiscal and monetary stability? Do they have anything in common with ecological sustainability? In a paradoxical way, rather unstable countries do favour sustainability more than stable ones, because after instability, restriction packages are introduced that aim at reducing wages, budget outlays, and imports. However, as instability has been partly caused by former high liquidity and excessive spending, the result of the different swings from an environmental point is neutral.

In case of the developed countries, a "sustainable economy" should be an environment friendly economy with alternative production and consumption structures, a high share of renewables in the energy sector and an ecological tax reform that eases burdens on labour and shifts charges on the use of energy, materials and the environment. In the final instance, a "sustainable economy" in the non-ecological sense is the opposite of what has been said above; ecological sustainability demands a "stationary" economy, i.e., without growth.[27]

The "sustainable society"

To speak about the social side or "leg" of sustainability is even a bigger attack on common sense. Do high unemployment, big differences in culture and incomes, and the lack of tolerance and non-discrimination make a society "unsustainable"? From the ecological viewpoint no, it does not. It is the same for the natural environment; whether these characteristics do prevail or not, they are not relevant. Property and income distribution does not affect the state of the environment; low employment rather favours it. From the viewpoint of welfare economics, income differences do not count either. The social welfare function can be maximized at both low and high income differences. From a non-ecological viewpoint it is a question of politics and

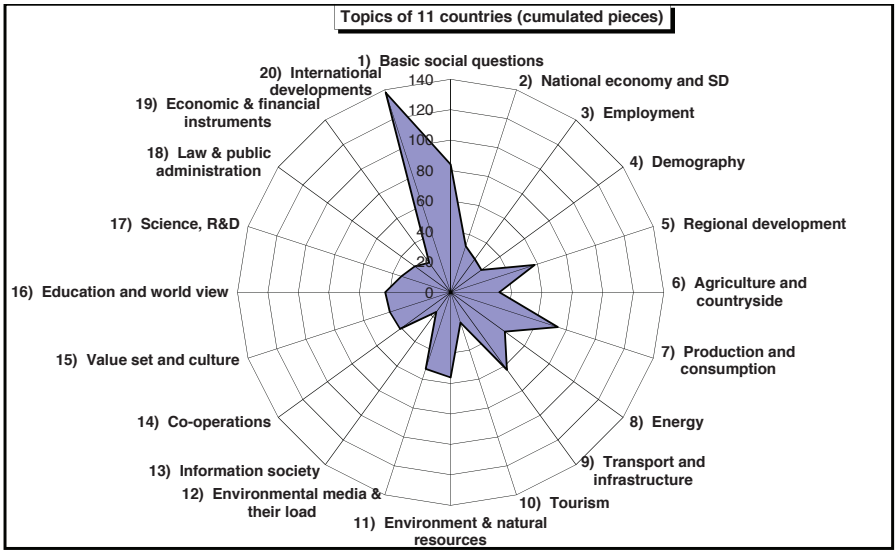
[27] See Daly's Steady-State Economics.

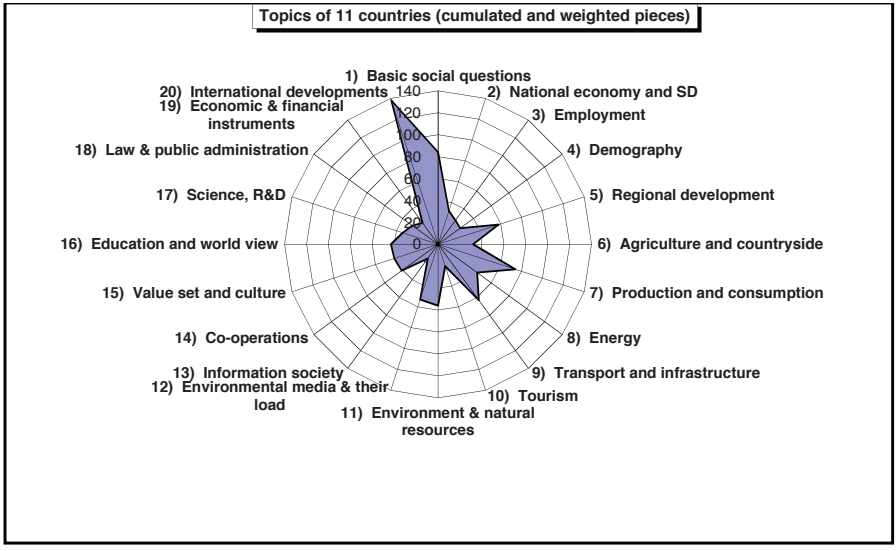
ideology. Objectively, the above society is not "sustainable," if it does not tolerate these characteristics and rises up against them (= social revolution).

This broadening of the concept of sustainability leads to its unlimited use, misuse, and abuse. During the past years all European countries developed their so-called SDSs (Sustainable Development Strategies). However, a short review of these strategies reveals that they are ecologically unsustainable, and the expression is a mere lip service to the environmental expectations. The proper title for these strategies should be environment-friendly development strategies.

One could argue that, in the final analysis, this does not cause any harm because it stresses the importance of the environmental issue. Nonetheless, this is untrue. These national development strategies suggest that if the economy and the society are all right, so is the environment. They pretend to appear as if we were in the right direction, but we are not. With all these national sustainable strategies, sustainable industrial concepts, and sustainable corporations, we are heading for an unsustainable world.

These figures on next page contain the discussed topics of the Sustainable Development Strategies of 11 European countries. For sustainable development the topics: 2) national economy and sustainable development, 12) environmental media and effects, 11) natural environment and resources, and 8) energy economy would be of high priority. Still, most attention is paid to 20) international processes and 1) basic social questions. (The 11 countries are: Austria, Germany, Ireland, Greece, Great Britain, the Netherlands, Sweden, Switzerland, Poland, Slovakia, and Hungary.)





Source: Nemzeti Fejlesztési Hivatal, FFS tervezési segédlet, 2005.

Is sustainability negotiable?

Those individuals who are speaking about the economic and social "legs" or "pillars" of sustainability unintentionally have in mind an arrangement when, e.g., during wage negotiations, the trade unions, the employers, and representatives of the government reach a compromise. Such items as the volume of state budget deficit, pace of economic growth, and measure of inflation all may be subjects of negotiations and compromise. Hence a false conclusion comes. Ecological sustainability, although it can be either promoted or impeded by economic and social factors, basically is a term belonging to the natural sciences, and, as such, it cannot be a subject of negotiations. It could be negotiable: What will be the contribution of the different industries or social layers to sustainability? However, it cannot be negotiable that a certain level of environmental load will conclude at an irreversible damage, i.e., an ecologically unsustainable state. If I jump out from the fifth floor, I shall be inevitably smashed dead. I cannot negotiate a business with gravitation that it could affect me only a half or a quarter of its force. At the present pace of deforestation of rain forests, it cannot be negotiated that climate disorders should not increase and loss of biodiversity should stop. The achievement of certain economic or social goals (a progress on the scale of "economic and social sustainability") cannot neutralize the following environmental damage (unless it is reversible). A progress in the so called economic and social sustainability cannot neutralize irreversible environmental damage. This is the reason why it is dangerous to speak about the "legs" or "pillars" of sustainability. It raises the misbelief as if progress in the economic and social dimensions could reduce environmental risks and compensate environmental damage. But if an individual does not even know these environmental risks, that person has a good occasion to propagate his or her economic or social opinions or political views under the disguise of sustainability.

Deadlocks in actual definitions

According to me even the biggest names of the profession and international organizations commit serious errors. E.g., *Donella Meadowset al*. writes that a sustainable society is to survive for generations, it is functional and far-sighted enough, flexible and wise enough not to destroy its physical or social welfare systems.[28] The Roman Empire lived through many generations and it "worked", but at last it collapsed because of "structural" problems. (Besides, due to extensive logging for ship building forests in the Mediterranean were seriously damaged.) Was it sustainable? I can hardly imagine a clumsier definition than this.

A paper by the UNECE writes that on the basis of capital formation approach sustainable development could be interpreted as wealth per capita which does not decrease by time.[29] But we should specify what kind of wealth it is about. A permanent growth of physical infrastructure is most harmful for the natural environment.

The UNECE paper also defines sustainable development as the increase of welfare during a very long time which is equal to the increase of consumption during a very long period.[30] It seems that the authors of this UN document mixed sustainable development with consumer society and probably they have never heard about ecological economics and the environmental burden of consumption.

It is known that former French President Sárközy commissioned Nobel laureate Joseph Stiglitz to elaborate indicators for sustainability and alternatives for GDP. The so called Stiglitz, Sen (another Nobel prize winner) and Fitoussi report considers the wealth left for next generations as central issue in sustainable development. It mentions physical, natural, human and social capitals. Concerning physical capital, the same problem emerges as above: capital for extracting and processing fossil

[28] Meadows et al. 2005, p. 253. This example was taken from Karcagi-Kováts Andrea: Mivel mérjük a fenntarthatóságot? [How to measure sustainability?] 2011.
[29]UNECE: Measuring Sustainable Development, 2009, p. 41.
[30] I.e., p. 34. (The UNECE examples are also taken from Karcagi-Kováts Andrea.)

energies, capital stock of heavy industry or heavy chemicals should definitely be decreased for the sake of sustainable development.

Karcagi-Kováts Andrea extensively examines the literature of the so called „sustainability indicators". She concludes that although these indicators and their sets measure important fields of economy, society, natural environment and their intercourse, due to the basic theoretical confusion they cause, they do not give a clear picture of sustainable development in general.[31]

An American movement called *voluntary simplicity* appeared as a counterpart to consumer society. It has spiritual and religious roots and Henry Thoreau is considered to be its American founder in the modern ages. Following this concept the notion of *sustainable living* has been coined. These intentions are very honourable but we must state that ecological sustainability is not only a direction, it has a quantitative side as well and living is only sustainable if it remains within the carrying an renewable capacities of the biosphere.

Christian intellectuals frequently couple Christian values with sustainable living, meaning that the simple way of life, the moral sentiments towards other people and other living creatures and our natural environment evidently result in sustainability.[32] My comment to this is the same as in the above paragraph, not to speak about the time necessity of such a change.

[31] Karcagi-Kováts Andrea: Mivel mérjük a fenntarthatóságot? [How to measure sustainability?] 2011.
[32] See e.g. Kocsis Tamás: Gyökereink – Örömről és gazdagságról egy világméretű fogyasztói társadalomban. [Roots. Of Happiness and Economy in the World-Wide Consumer Society], 2002.

III. Levels of sustainability

Global sustainability

As the global ecosystem is one highly complex system with a self-regulating capacity and the capability to optimize living conditions for its components (see the Gaia hypothesis by Lovelock)[33], we should speak of sustainability, first of all, as a global concept, as this is truly the case. Of course, the interpretation of the term is not so evident. For example, how much time do we "give" the environment to renew itself or to "process" the waste? (I.e. within what time scope do we interpret sustainability?) Furthermore, what damage volume is affordable in the local and small-scale ecosystems that does not endanger the global ecosystems? Whether excessive deforestation in one region may be mitigated by forestation in other regions, damage caused to a local ecosystem may be mitigated by harnessing similar ecosystems in other places, and whether the overuse and damage of a local ecosystem could be mitigated by the protection of a similar ecosystem elsewhere, namely, whether the different ecosystems are capable of replacing each other. For the sake of simplicity, let us suppose that for these questions the answers are positive. (Of course, the case is more complicated; we have to suppose that the damage does not trigger irreversible processes in the neighbouring ecosystems and habitats.)

We frequently meet frightening data about global deforestation, spreading of the deserts, melting of the ice caps on the poles and Greenland, loss of biodiversity, escaping methane in the permafrost, rising global temperature and even rising sea levels and sea temperature. All these phenomena are well illustrated by the synthetic indicators of global environmental footprint.

[33] Lovelock, Gaia, 2000.

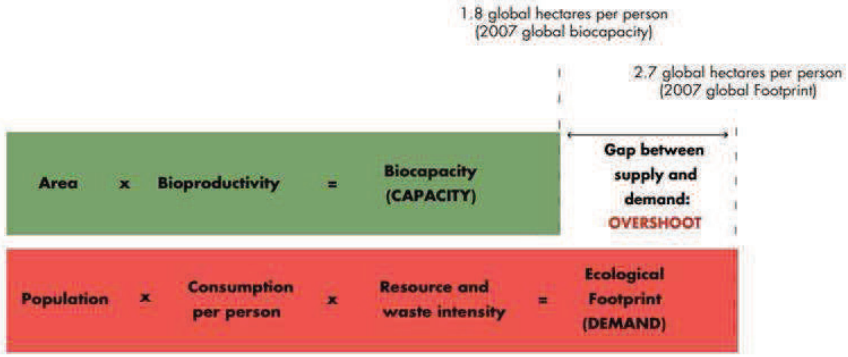
Ecological footprint
(global ha/person)

country group	production	net exports*	consumption	bio-capacity	deficit
World	2,70	-	2,70	1,78	0,92
Low income	1,06	- 0,13	1,19	1,08	0,11
Lower-middle income	1,62	- 0,02	1,64	1,03	0,61
Upper –middle income	3,57	0,26	3,31	4,63	+ 1,32
High income	5,75	- 0,31	6,09	3,06	3,03

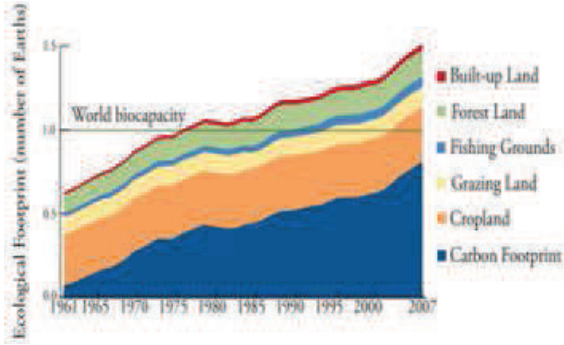
* This calculation considers the footprint of exports and imports as well. If the footprint of the imports of a country is higher than that of the exports that means that this country „outsources" the environment unfriendly activities. As a result, this burden should be added to its consumption.
Source: Ecological Footprint Atlas, 2010.

According to the ecological footprints for 2010 the global biocapacity was 1,78 global hectar per person (gha/cap), while that of the world consumption or production 2,70, resulting in a 0,92 deficit. This means that every inhabitant of the world causes a 0,92 global hectar overuse of the natural environment. In other words, we live as we had 1,5 globes. Rich countries live as we had two globes.

It is frightening that even the poorest countries of Africa and Asia have a footprint deficit. The reason is that their biocapacity is very low. In the group of lower- middle income countries we have China, India and Indonesia. Although their biocapacity in per capita terms is the lowest, their deficit is below average, because in per capita term they do not pollute the environment very seriously. The group of upper-middle income countries (Argentina, Brazil, Russia, Mexico, etc.) cause surprise; they do not have a deficit, to the contrary, they have a surplus in the global environmental footprint. This is explained by their very high biocapacity (except Mexico). (To explain the above terms see chart from Ecological Footprint Atlas 2010, p. 23.)

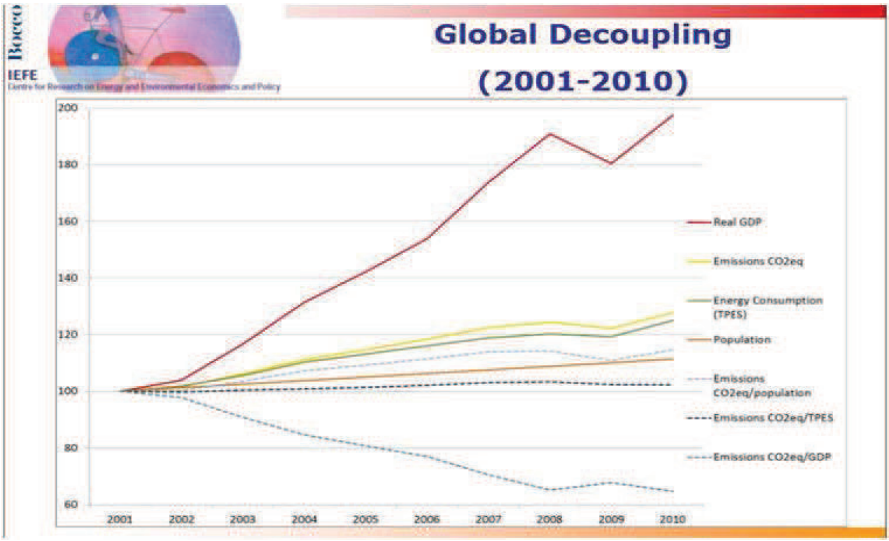


While global biocapacity is not increasing (to the contrary, the nature's reproducing capacity is worsening), global footprint is increasing. As a result, since the 'eighties global environmental burden has overtaken biocapacity. It is the carbon footprint that has the highest share then come agriculture and grazing, deforestation also takes a serious part in it.



Source: Ecological Footprint Atlas 2010, p. 18.

A major issue arises: whether technological development and sectoral shifts towards services could mitigate the increasing environmental burden due to higher population and bigger economic activity. The terms "dematerialization" and "decoupling" have been forged to illustrate these phenomena.



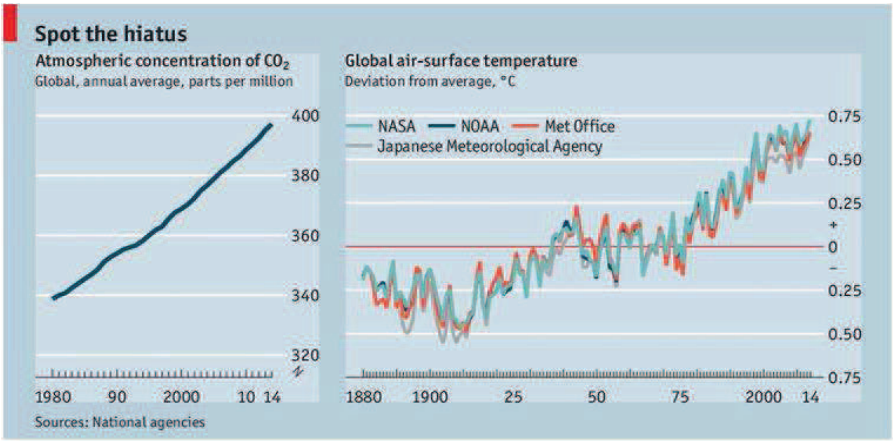
Source: Edoardo Croci, 2014.

The above figure illustrates well decoupling. While global GDP almost doubled between 2001 and 2010, CO_2 equivalent emissions and energy consumption increased by less than 30 percent. As a result, emissions per unit of GDP sharply sank. Still, from the environmental viewpoint increase of emissions and energy consumption are decisive; namely, the environmental burden further increased.

Climate change

This is the most important global environmental problem and at the same time, the most important component of sustainability. The world is 0,75°C warmer than it was before the industrial revolution. International community should like to keep warming below 2°C by 2100 but if trends will go on like this, 4,5°C will be probable. According to the general opinion, causes are of anthropogenic origin but many scientists deny it.

The tragedy lies in that the process is accumulative and reinforcing due to negative feedbacks. As the ice in the Arctic and Greenland melts, the albedo of the Earth's surface decreases and more light will be absorbed which causes more warming. A very huge amount of methane is frozen in permafrost soils which has begun to leak. (The greenhouse effect of methane is 20-40 times bigger than that of CO_2.) With higher temperature leakage will increase and result in higher temperature which may annul all human efforts in climate mitigation.[34] Similar leakage of methane from the methane-hydrate on the sea-beds has begun. A very frightening sign is that sea temperature also has begun to rise. When such an immensely huge volume begins to change nobody could imagine how it should stop.



Source: The Economist October 3rd 2015

I myself hope only in fortune. The Earth, the climate and the biosphere make an immensely complex system. Change of such complex systems can be explained only by chaos theory. Namely, even the change in a very insignificant component may trigger off motions which result in unforeseeable changes. This is well illustrated with what has happened: CO_2 content in the atmosphere has increased from 0,03 to

[34] In 2011 there were 515 billion tonnes of CO2 in the air. The yearly increase is 140 billion tonnes. To keep warming to just 2°C by the end of the century, the stock of atmospheric CO2 must be kept under 1 trillion. Around 1,700 gigatonnes of carbon are held in permafrost soils. (The Economist, 3rd 2015.) 1,700 gigatonnes = 1,700 billion tonnes = 1.7 trillion tonnes.

0,04 percent and this tiny change evolves in a huge, dramatic climate disorder. (Supposing that climate change is really anthropogenic.) As an analogue to this I can imagine that a tiny change (e.g. the extinction of a species, or to the contrary, the increase of a population, or a change in a habitat, or in any other geo-physical characteristic of the Earth and atmosphere) could result in the reversal of the process.

The 1997 Kyoto Protocol started a good scheme: signatories to the deal took the obligation to reduce CO_2 emission by an average of 5 percent in the years 2008-2012 compared to the level of 1990. Unfortunately, the agreement could not be prolonged despite of continuous efforts. China and the USA are the main opponents. Although since 2005 China is the main single emitter of greenhouse gases, it does not want to undertake obligations similar to the most developed countries arguing that it is not responsible for the emerging of the problem. (This is the issue of "historical" emissions; the cumulated emission of China since the industrial revolution is only one third of America.) This argument may be considered somehow funded. But the standpoint of the USA cannot be excused. The USA claims an equal "treatment" which is simply nonsense: in per capita terms poor countries emit only a fraction of that of the USA.

As neither the USA, nor China is willing to undertake mandatory numeric obligations in emission reduction, the UN has changed its policy line: countries should undertake voluntary obligations individually. The Economist of 3rd October 2015 reports these individual obligations. "America's Clean Power Plan ... could reduce carbon-dioxide emissions from power stations by 870m tonnes by 2030 – a cut of almost a third from 2005 levels and the equivalent of taking 166m cars off the road. China has promised that its emissions will peak in 2030, if not before. ... China could launch a national carbon trading scheme in 2017. ... Brazil pledged to cut greenhouse gas emissions by 43% by 2030 compared with levels in 2005."[35]

[35] The Economist 3rd October 2015.

According to the IPCC[36] a 50-80 percent green house gas increase is needed by the middle of the century in order to be able to keep global temperature increase within the critical 2°C.[37] With a view on this we can state that the EU is the most responsible region of the world in the field of climate mitigation.

Deforestation

Neither could an efficient agreement to protect **rainforests** be concluded. Rural populations of Brazil and Indonesia burns rain forests to gain arable land. Governments of the countries with rain forests not only allow the activities of logging firms, but sometimes even subsidize them. In Indonesia and South East Asia international companies are allowed to convert rainforests into palmolive plantations. Rain forests are global natural common goods. The responsibility for their conservation also should be common. We cannot expect governments of the poor countries with rainforests to retrain themselves from utilizing resources embedded in the rainforest regions.[38]

Let us make it clear: the problem should be managed according to the theorem of Ronald Coase: poor countries and local communities should be compensated for not damaging rainforests. And the sum of this compensation should equal the marginal benefit caused by non-deforestation. This sum could make up tens of billions of dollars with reference to the value of a not changing climate, the non-increasing of climate disorders and the conservation of species diversity. But the international community has only some hundred million dollars for saving forests.

As a result we can conclude that although sustainability should be interpreted first of all on global levels, there are no global authorities and competencies which could retain national states from damaging the environment. In international politics the

[36] Intergovernmental Panel on Climate Change, an expert panel of UNO.
[37] According to James Lovelock, the most eminent scientist in the field of the biosphere-climate interaction the global warming cannot be stopped anymore; due to the negative feedbacks the process became self-strengthening and self-accumulating. (Der Spiegel 5/2007)
[38] One of the schemes implemented by international organizations is like this: if a community, living in the rainforest region preserves forests in its neighborhood, it will be remunerated with a certain sum.

UN can enforce states to observe the wish of the international community, because in the final instance UN and NATO forces are implemented. The case is similar in international trade. If a country does not comply with the rules of the GATT/WTO, other countries will enforce compliance by trading restrictions and embargos. In contrast to this, observation of more than one and a half hundreds of international environmental agreements are not compulsory; in this field compliance is voluntary, a question of rather good behaviour and decency and intention than enforcement. The question arises: why enforcement does not happen in the field of environment? The answer is simple: the mightiest countries, namely the USA and China are not interested in creating such an international system which should enforce environmental obligations.

The national level

Although sustainability is a global concept, we interpret it on the national level as well and regulation is mostly designed on the national level. This is only justified by the fact that there exist sovereign states, and, therefore, the responsibility for the use and load of the biosphere is shared within them. Responsibility is allocated on the national level. There are no international authorities that could fully take the responsibility of protecting the global environment. (Hence the free ride in the global commons comes: as individual states cannot be neither closed out of using them, nor forced to comply with the requirements of global sustainability, they overuse it. This is why the introduction of a global emission trading scheme is so difficult; the original deal of the emission rights could be done according to several criteria, and each single criterion affects the different interests of nations in a different way.)

Ecological footprint by selected countries

(Global hectar per person)

country	production	net exports*	consumption	biocapacity	deficit
World	**2,70**	**-**	**2,70**	**1,78**	**0,92**
Argentina	5,57	2,97	2,60	7,50	-4,90
Austria	5,44	0,14	5,30	3,31	1,99
Brazil	3,46	0,56	2,91	8,98	-6,07
China	2,19	-0,03	2,21	0,98	1,23
Congo	0,99	0,02	0,96	13,27	-12,31
Czech Republic	5,95	0,22	5,73	2,67	3,06
Ethiopia	1,08	0,03	1,10	0,66	0,44
France	4,27	-0,74	5,01	3,00	2,01
Germany	4,72	-0,36	5,08	1,92	3,16
Hungary	3,45	0,46	2,99	2,23	0,76
India	0,91	0,00	0,91	0,51	0,40
Japan	3,55	-1,18	4,73	0,60	4,13
Netherlands	4,20	-2,00	6,19	1,03	5,16
Russia	5,15	0,74	4,41	5,75	-1,34
Saudi Arabia	4,39	-0,74	5,13	0,84	4,29
Sweden	8,39	2,50	5,88	9,75	-3,87
USA	7,99	-0,01	8,00	3,87	4,13

* See note at the Global footprint table.

Source: Ecological Footprint Atlas, 2010.

The best sustainability indicator on the country level is the ecological footprint. The survey of the ecological footprints of different states reveals the next major characteristics:

- The more developed is a country the heavier it loads the environment. (The production footprint of the USA is 7,99 gha/capita, Germany 4,72, France 4,27, the Netherlands 4,20, Sweden 8,39.) The high production footprints of countries like Saudi Arabia and Russia are due to the extensive oil and gas exploitation, that of Brazil due to extensive logging.

- The balance of footprints of exports and imports slightly modifies the above indicators.
- The biocapacity is the other major factor of a country's environmental load. Big territories with low population density and high bioproductivity mitigate the environmental burden of production. This is, why Brazil, Argentine, Sweden or Russia have surpluses in environmental footprint, instead of deficits.
- In case of India or Ethiopia a very low production footprint is combined with a very low biocapacity. This results slight deficits. While, Congo has a very high surplus, due to the low production and very high biocapacity.
- Anyhow, countries with high environmental footprint deficits are mostly the highly industrialized ones: USA, Germany, Japan, the Netherlands, etc.

As a result, we cannot say that the poorest countries are the only ones that are ecologically sustainable. Thinking in global ecological footprints, developed and emerging countries mostly surpass the carrying capacity.

It was the Dutch who firstly elaborated a National Environmental Policy Plan (for 1990-1994, To Choose or to Loose). This was followed by the British, the German and the Scandinavians and others.[39] It was remarkable that market economies developed long term national plans and especially in the field of environment. This could be explained by that long term thinking and integration with all other fields of the economy are especially important and relevant in environmental policy.

Later – as it was mentioned in the section dealing with "sustainable society" – so called Sustainable Development Strategies were prepared all over Europe, which were based on the "three leg" approach.

[39] Hungary prepared its first National Environmental Programme for 1997-2002 in 1996.

Growth mania

Actually we live, produce and consume as we had 1,5 Earths. But we have only one. Growth has its limits. The global economy should not grow. But we have the possibilities to develop, to have a growth which does not load further the environment. This growth – more exactly development – should focus on reducing energy and material intensity. In all fields of production and consumption we have alternatives: the more and the less environment damaging variants. A national economic policy should support these environment friendly alternatives. It should favour education, energy efficiency, technological development, digitalization, employment and life quality. All these endeavours improve competitiveness.

A marked orientation of environmental sciences is sharply against any kind of growth. (See the concept of "No growth".) Above, I was arguing that certain kind of growth is affordable even from the environmental standpoint. The anti-growth orientation needs further specification. We cannot say that no country should grow. Less developed countries should be allowed to have growth. International community should not say that the poorest countries should not grow. Even middle income countries should be allowed to grow. E.g., Hungary is seriously indebted. Without growth it could not cope with its economic problems. Besides, Hungary's contribution to global green house gas emissions is 0,2 percent. Evidently, even if it stopped total emission, it did not count at all on the global level. For a small, middle income country climate protection is a moral issue. On the other hand, there is a striking coincidence. Economic rationality demands to implement exactly those measures, which should be introduced against global warming. (E.g., increasing energy efficiency, decreasing energy intensity, putting emphasis on services like education, health, digitalization, etc.)

Local level and the global-local dimension

According to some environmentalists the solution against the deterioration of global environment lies in the hands of localities and local communities. Each community is interested in protecting its neighbouring environment. As a result, they should fully dispose of the lands, forests, waters, minerals in their territory and safeguard their sustainable use. I think this is a naive concept. Humanity cannot do without trade and cooperation. No community is able to self supply. They have to specialize for some production in which they have comparative advantages and then trade. No one could tell how far this specialization and trade could go. The idea of local sustainability collapses. The local autarchy is counterproductive to the environment. Let us remember the case of Chinese peoples' furnaces. No iron production in world history (including that of the Celts before Hungarians occupied the Carpathian basin in the 9th century) could cause so much harm to the environment in terms of per ton of iron.

Still, emphasizing local activity against global economy is of high importance. Global economy is very transport-intensive. Let us think about the huge container ships and container harbours. Today some 18-20 million containers are constantly crisscrossing the seven seas. These standardized receptacles have become the building blocks of the global village. Or let us think about the immensely great traffic of heavy trucks on our roads. These monsters reach even the 40 ton weight. Global division of labour is indispensable. E.g., the A380 airplane is constructed in European cooperation, with the participation of Spanish, German, English and French factories. Americans will construct the Boeing 787 with the participation of several European and Asian countries and Australia. In the case of highly sophisticated technologies this is reasonable. But this global traffic gives possibility to and triggers off an excessive and partly superfluous international division of labour as well. E.g., what does justify that the Sonicare Elite 7000 electronic tooth brush is produced in 11 factories dispersed in three continents? Or is it rational, that fruits of remote continents are available in all seasons in the supermarkets of the big

global food changes? The same relates to wines of remote countries, French cheeses, Chinese produces, etc.

International division of labour has mostly positive effects on the environment. It optimizes energy and material resource use. A given product is produced in that country or town where it needs the minimal energy, material and labour input. But at the same time, traffic and shipping are very energy intensive and the division of labour sometimes is counterproductive from the environmental point of view. This contradiction could be easily solved – at least theoretically: energy and fuel should be priced on the social-environmental optimal level. Namely, all the negative externalities should be included in the fuel prices. This would substantially increase energy and fuel prices, decrease transport and shipping volumes and reduce international division of labour to an optimal level.[40]

Having all this in mind and knowing that chances of the formation of a global socially-environmentally optimal pricing system are not immediate, we have to work on strengthening local economies. Local agricultural products, meats and milk should preferably be processed locally. This reduces transport costs, creates more jobs locally which similarly reduces traffic. The creation of local money may greatly support the development of local economy. As a result, the serious environmental burden caused by traffic and transport will diminish.

David C. Korten, in his book *When corporations rule the world* adds some more arguments to the importance of local economy: local people can control the use of their resources and may preserve their social norms.[41]

[40] I have been focusing on the most important factor, energy and fuel. But in order to have a social-environmental optimum, all other externalities relating to the use of natural environment should be taken into account.
[41] Korten, David C. When corporations rule the world, 2009.

Agglomeration and urbanization

http://www.energsustainsoc.com/content/4/1/7/figure/F1?highres=y

According to Alvin Toffler, a future researcher, Americans are less afraid of crime and unemployment than of the traffic problems caused by the spreading megalopolises and the permanent traffic strain. In the 1970's, in America high-tech moved out to the suburbs and technourbs have been formed (see Silicon Valley). They were followed by the education. The government supported family house building. Trade also went out in the form of big shopping malls available only by car. But agglomeration is characteristic to the emerging and developing countries as well. Growing agglomerations heavily affect the environment because of the big traffic constraint, increasing land use and loss of biodiversity..

There are a lot of possibilities to curb urban sprawl and make urbanization patterns more environment friendly. The idea of compact towns means building more apartment houses and less family homes. Car free streets with shops and cafés instead of car shopping centres attract pedestrians and buyers and ease traffic. Business prefers green field investments but this further increases land use. In some big cities investment in the rust belt is supported by different financial incentives.

"Sustainable city" programmes are widespread both in Europe and other parts of the world. The UN Habitat program favours combining social and environmental purposes in towns of the third world. In Europe, city rehabilitation programmes are frequently named as this. However, in a strict sense, a town cannot be "sustainable" because it cannot maintain itself on the given land surface. But in the metabolism a

town has with its surrounding countryside, it is theoretically possible that the productivity of the town is much higher and the interchange reduces its ecological footprint. (Namely, the environmental load of the industrial products of a town is less than that of the agricultural products supplied by the countryside.)

The industrial level

One frequently hears and reads such expressions as sustainable transport, sustainable energy industry, sustainable agriculture, and sustainable consumption, referring to the industrial or sectoral levels of sustainability. When qualifying industries as "sustainable", such characteristics are mentioned: transportation with a higher share of railways and public transport; more renewable energy production and use; biofarming; avoiding the use of disposable products, vegetarianism, etc.). But this is deceptive, the proper term would be *environment friendly* transport, industry, agriculture, consumption, etc. The concept of sustainability is not a synonym to environmentally friendly practices. If we consider the real sustainability requirement (namely that the activity of the given industry should observe the limits of ecological sustainability), the idea is not right. Countries have different natural endowments and economic structures, and they can achieve a balance on the national level (meaning that the activity of one industry that is unsustainable might be balanced by the activity of an environmental friendly sector). In this sense, we can disregard industrial sustainability. The requirement that each industry and field should be ecologically sustainable is unrealistic. Still, interpretation of sustainability on the industrial level (e.g., transportation) may make sense; it shows the individual environmental load of that industry. To strive for a sector-by-sector observation of the concept of sustainability would not be rational. For example, transportation would be sustainable only if it used exclusively renewable fuels, land use by highways should be mitigated by increasing natural absorption capacity in other fields, and vehicle wrecks should be completely recycled. (This latter requirement is even more difficult to comply with in the case of the construction industry—the reuse of demolition materials.) To expect the fossil fuel industry to be "sustainable"

is foolish. This expectation could be met if the industry would develop renewables in a parallel way that could replace fossil fuel production. But for this purpose, the fuel production should have to be excessively expensive or of low level.

Corporate sustainability

Even more intriguing is the use of sustainability on the corporate level. In a time when new concepts and disciplines are born like Corporate Social Responsibility and The Sustainable Firm,[42] and they aim at integrating the environmental and social imperatives of our age, it is difficult to argue against these concepts. However, I doubt whether firms other than those operating in alternative activities (such as producing renewables, organic farming, alternative sewage treatment) could be sustainable. In the overwhelming majority of the cases, when it is written sustainable firm, it should be read as environmental-friendly firm.

Almost 30 years have passed since Alfred Rappaport, professor at Northwestern University, swimming together with the newly emerging neoliberal tide, stated that the main aim of a firm must be the increase of shareholder value. Since that time managers strive brutally for that purpose, disregarding employees' interests, splitting firms, or liquidating, if shareholder value could be raised. As a natural reaction, the concept of socially responsible enterprise has been born (more exactly reborn, because this idea has been present in the American economy since the very beginning of the formation and activity of corporations as a reaction to the ruthlessness of anglo-saxonian capitalism). Also, as a new element, environmental responsibility has been added to the social one. Also in Europe the development has been different. The state had been playing welfare functions from the very beginning, which had been strengthened and institutionalized in the welfare state after the Second World War. Europe also followed the neoliberal tide from the beginning of the '80s,[43] and as a reaction, the concept of CSR, involving

[42]Corporate Citizenship, Corporate Social Responsiveness, Tripple Bottom Line, Stakeholder Theory; see at Málovics 2011, p. 42.
[43] More exactly since 1979, the first Government of Margaret Thatcher.

environmental responsibility, emerged. However, by now CSR in Europe is derived from the macro-level sustainability, as its pendant on the micro-level.[44]

The theoretical background is the cutting back of state functions, the demolition of the welfare state. In this case the question arises, if the intervention of the state both into the economy and the firms' affairs has been minimized (to the function of the "night guard state"), how could the firms be "disciplined"? In such conditions does the ethical behaviour and social and environmental responsibility of the firms come to the forefront? If the welfare state is demolished, it is the firms that have to play the functions of the welfare state, on a voluntary basis, on their own.

Changes in the instruments of environmental protection show a good analogy: the preference of voluntary instruments. The firm tries to get rid of the state regulation and suggests that it is alone capable of protecting the environment, solely motivated by its consciousness and responsibility.

In the context of a strong, responsible state, the voluntary "charity" of the firms is replaced by a redistribution of incomes through taxation; instead of the good treatment with the workers and employees, the strong trade unions validate their interests, and the environment is protected by strict government regulations, not by voluntary measures. As a result – although I am not a Friedman-ite, and moreover have contradictory views to him – in this respect I partly share his opinion (namely, that the firm's main function is increasing profit and not taking care of social and environmental concerns). I add that what is needed is not so much the responsible firm but the responsible state.

Returning to the ethical requirement of "good treatment" with the workers and employees, is there any system that equals the German "Mitbestimmung" or the Austrian "Sozialpartnerschaft" in this respect?

[44] Málovics 2011, p. 43.

A fashionable approach, the stakeholder theory, seems to be a different problem, but I think it could be traced to the same roots.[45] If markets were not so highly monopolized as they are today, and the economic playground were determined by a responsible state, the proper management of stakeholder contacts would not mean a favor on the part of the firms, but it would emerge as an external market obligation. At last, let us consider the role of the firm in the given town or region, and its contribution to the improvement of local conditions and the life of the local society. If it is a big foreign company or part of an international retail chain, it is really a grace from its part. However, for a local small- or medium-size firm, it is a natural favor to contribute to the welfare of the local community.

The creation of public goods like social cohesion, welfare, culture, and local development is the task of the government. A serious theoretical problem emerges if firms are charged with these tasks.

In the last resort, this basic theoretical question should be asked: How could the representation and realization of social and environmental interests be more successful, either if they emerge vis-à-vis the firms as external government, social demands, and forcings, or if they are served by voluntary firm decisions? For me the answer is evident: we should choose the first path and the second could be only additional (second best).

Environment protection in the European Union[46]

(the level of regional integration)

Discussing levels of sustainability we deal with the level of regional integration as well. The question to be examined is how does the EU affect the environmental conditions of the member states; whether the environmental policy and institutional

[45] See: Málovics 2011.

[46] The main source of this section is Kiss Károly: Green Economic policy, 2009, web. Section XVII.

setup of the EU has any additional positive impact on the environmental policies of the member countries?

The Common Market has environmental action plans for the medium term since 1973. But it was the 1987 Single European Act which raised environment protection among the main goals of the Community. It has created a direct legal background for the common environment policy measures. But economic and trade issues were given priority vis-á-vis the environment and environment protection is considered as a trade limiting factor. If a member country has a regulation which is less strict than that of other countries, it is asked by the Commission to approach its standard to the average. (The point is that nobody should enjoy competition advantage due to its loose environmental regulation.) And this works to the opposite direction as well. The 1995 EFTA enlargement illustrated very well this rule. In EFTA countries level of environmental regulation was generally stricter than in the older member countries. Therefore, they had to loosen their regulation not to raise obstacles to the export products of the older country members.[47] Since 1st January 1993 the main goal of the EU has been the viability of the common market and the euro. As a result, environmental protection, social policy and labour protection have played subordinated roles.

The fields where the EU plays really very positive roles in environment protection are energy and climate policy, common agricultural policy and regional development, biodiversity and nature preservation and waste management.

In the energy sector one of the most important results of common policies is the harmonized minimum tax rate on energies. In 1992 this related to the excise duties on fuels and the fuel oil, but since 2003 it covers coal, gas and electricity as well. These rates – not counting with the excise duties on fuels – are very law. This instrument illustrates the environmental policy of the EU in its totality: unanimity is

[47] Let us imagine that an Italian firm wanted to export its construction work machine to Scandinavia, where noise standards were more severe. As a result, this firm was handicapped on the Scandinaian markets. This is, why the new member states had to loosen their standards.

– in most cases – a condition of common policy measure. As a result, the level of the common environmental policy goals and requirements is fixed on the levels of those countries which have the lowest environmental requirements. These countries are those of the Southern and Eastern belts plus Ireland.

In 1997 the liberalization of the energy sector has started in the EU. In some countries (including Germany, Great Britain, Finland, Sweden and Denmark) liberalization has been completed in some years and after the big industrial consumers households also could enter the energy markets and stock exchanges. In more centralized countries, like France, the process was slower. From the environmental point of view the results were doubtful. Liberalization has made possible that small capacity renewable energy producers also could feed in the big electricity grids and the consumers with a preference for green energy could make deals with the renewable producers on the electricity stock exchanges. At the same time, liberalization reduced energy prices and consumption increased. Later, in more countries a process of fusions and monopolization has started in the energy markets, which raised prices again. The European Commission tried to slow down this process by requiring that a company cannot hold both the power plant and the grid. The idea of liberalization of the energy market started from the USA, where experiences were unambiguously not positive.

The EU has made significant efforts in climate policy; both in aiming high goals and introducing a market mechanism to realize those aims. While the 1997 Kyoto Protocol was not ratified by the USA (and several other developed countries), the EU undertook an 8 percent decrease of green house gases, in contrast to the 5 percent goal of the Protocol.[48] (Within the general 8 percent commitment, the decrease was distributed in a very fair manner: the most developed member countries had to fulfil a higher target, while less developed ones could even increase their emission.)

[48] These goals mean an average decrease of the period 2008-2012 related to the 1990 base emission.

Beginning with 2009, there were yearly conferences to prolong the Protocol without any success. In 2012, there was a trial for the second commitment period, the Doha Amendment. The EU also played a leading role, but the USA still did not cooperate and the number of some 36 countries was not enough that the agreement entered into force. Irrespective of the international failures, the EU unilaterally undertakes commitments. E.g., to achieve a 20 percent decrease in green house gas emission by 2020, it aims at a 20 percent reduction in energy use, a 20 percent increase in energy efficiency and reaching a 20 percent renewable energy share also by 2020. (Within this last goal the share of biofuels should reach 4 percent.)

To reach the green house gas reduction aims the EU introduced its own emission trading scheme (ETS). This system makes possible that those industries where the marginal abatement costs are relatively lower, could reduce more pollution and the surplus could be traded with those polluters where these costs are higher. The ETS covers almost half of all emissions but the so called diffused polluters (traffic and households) and the agriculture and chemical industry are not involved. The ETS functions well, but a major problem is that allowances produced outside the EU, mainly in the developing and emerging countries are also circulating in the system, due to the so called Kyoto flexibility mechanisms. This makes the system leak. Besides, the most developed member states prefer to reduce green house gases in the less developed member countries where marginal abatement costs are lower.

The European Commission has dealt extensively with transport and traffic policy. These common documents are aware of the threats transport means to the environment. Still they are not satisfactory from the environmental point of view. These concepts aim at equally considering economic and environmental necessities what we see as mistaken. Namely, from the environmental point of view a correct transport policy should be „demand-sided"; it should try to restrict transport demands. But these common documents mostly accept the actual demands in road traffic and transport while emphasize the development of rail as well. Another

endeavour of the Commission is that car manufacturers should decrease specific CO_2 emission.

We should have in mind the interconnection between the single market and transport as well. Transport plays an absolutely basic role in the well functioning of the single market; efficiency on the level of integration should be reached and division of labour should be optimal. Consequently we face a contradiction between environment protection and single market, what cannot be easily solved for the time being.

If we consider the single items of the common budget of the EU, we could state that the most important policy field is agriculture because it takes 43-45 percent of common money. But this agricultural policy is seriously mistaken from the environmental point of view. It heavily subsidizes intensive farming which uses much energy, machinery and chemicals. All this heavily damages the environment.[49]Together with energy and transport, agriculture is one of the activities which have the highest burden on environment.

Since the 1992 reform of Common Agricultural Policy we testify slow but promising changes. A conceptual change has been taken: the highly industrialized agriculture should be pushed back and a return to the concept of traditional agriculture is needed: the agriculture should fulfil other functions than food production as well. The branch has to play other important functions like landscape management, preserving ecological living space, keeping rural population, preserving values of rural way of life, rural tourism and producing renewable energies. This is called multifunctional agriculture. From the point of economics, the non food producing functions could be called non importable public goods, i.e. externalities.

[49] For decades, the major problem of the agriculture in the EU was overproduction. But lately, due to the critical world situation in food, this problem has been easing.

And hence we have a well based argument why and how the huge support system of agriculture should be reformed. Subsidies should not be spent on food production, namely a market function, because that causes market distortion. Subsidies should be spent on the non food producing functions which are agricultural public goods, i.e. positive externalities. And, as economics teaches, negative externalities should be internalized (taxed, or pushed back in other ways), while positive externalities should be supported.

As a result, the Common Agricultural Policy aims at the complete overhaul of the system: market subsidies should be transformed into agro-environmental subsidies. But this transformation is much slower than expected.

The production of renewable energies and bio-fuels seemed to give huge possibilities to the agriculture. But when there is a global lack in food, serious ethical obstacles emerge in front of using these possibilities. Besides, the energy balance of some bio-fuels is not favourable, sometimes even negative.

The chemical industry raises serious hazards both to human health and the natural environment. With the REACH programme (Registration, Evaluation and Authorisation of Chemicals) the EU has introduced an efficient tool against these hazards. The REACH compels producers to test chemicals against environmental and health risks even ex post facto. Due to the immensely big number of chemical products and the complicated character of the tests, costs are very high. Chemical producers have to cover the costs of these tests and in case of suspicion they have to prove that the product is safe.

The waste management policy of the EU sets a priority order: first, avoiding waste formation, second, waste usage, third, deposition. Waste usage may have different forms: reuse, refund, recycle and composting. Environmentalists heavily criticize waste incineration as a form of waste reuse because the energy balance of household waste incineration is negative. According to the regulation of the Single Market, waste is a tradable good. This gives ground to a lot of abuses: some companies pay

to firms in less exigent countries, that their waste should be taken. In these countries the waste is simply illegally deposited instead of reuse. In contrast to this, trade in hazardous wastes is strictly regulated, including setting transport conditions. A former goal of the Commission was to decrease household waste under the 500 kg/capita limit but this did not succeed; household waste formation is increasing in the developed countries.

Protection of biodiversity has three ways in the EU. Firstly, directives regulate how to protect endangered species and their habitat. Secondly, since 1992 the Life programme finances reconstruction and conservation of habitats which are of EU importance. Thirdly, the EU has established the Natura 2000 network, with the participation of the member countries. This aims at reunification of habitats which are cut by country borders.[50]

Within the 7 year long common budgets of the EU it is the Cohesion Fund which finances the environment protection. The Cohesion Fund finances sewage purification and treatment, waste management and other establishments of environment protection in less developed regions. The Life programme – as mentioned above – directly finances conservation of biodiverstiy. And subsidies for agro-environmental protection also should be mentioned here. Comprising all this, the EU spends some 7-8 percent of its budget on environment protection. Taking into consideration that environmental protection has a 1,2-2 percent share in national budgets, this is very remarkable.

Summing up, the European Union makes serious efforts to protect natural environment. No doubt, Europe is a leading continent in this respect. One may ask, why is this brave attitude? Europe is developed in producing positive externalities: both in education and social policy. Earlier, these had strengthened social cohesion and improved competitiveness. However, with new phases of globalization, Europe is losing competitiveness. But the leading role in environment protection is still

[50] Cutting habitats may lead to the extinction of species living on that territory.

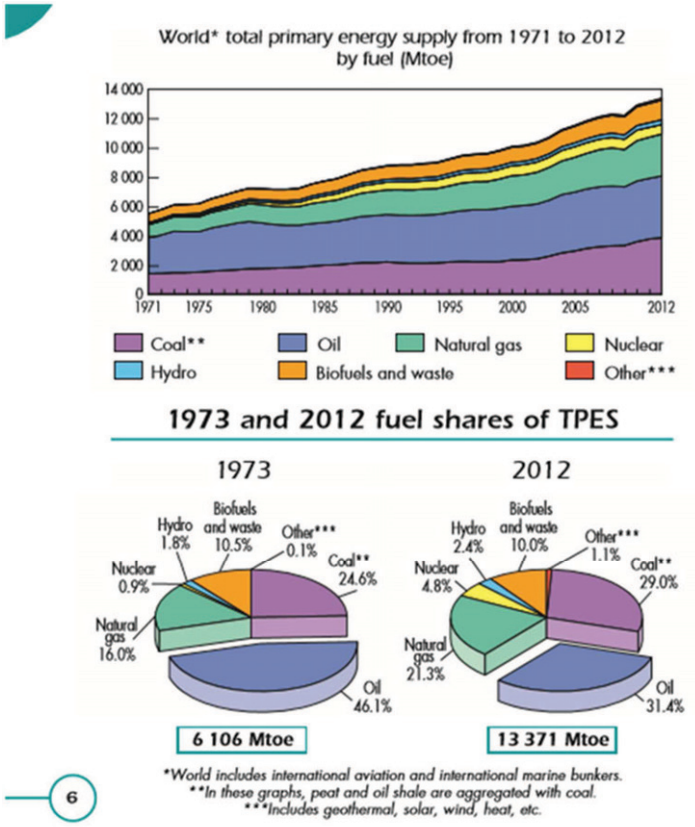
preserved. But all this has nothing to do with sustainability. The European Union lays more emphasis on environment protection than other regions and continents and its regulation and institutions positively stimulate environmental policies in member countries.

IV. Environment friendly industrial policies
("sustainable" industries)

The energy sector

The biggest source of CO_2 and other green house gases is the energy sector. It has a 24 percent share in worldwide CO_2 emission. Both the production and procession and use of energy cause very serious environment pollution. As a result, the analysis of the energy sector is of high importance.

Between 1973 and 2012 the total world primary energy supply more than doubled. The biggest single energy source is still oil, although its share decreased from 46,1 to 31,4 percent. Coal increased from 24,6 to 29 percent and natural gas from 16 to 21,3 percent. Nuclear energy also increased its share from 0,9 to 4,8 percent. On the table and diagram by the Key World Energy Statistics 2014 wood and renewables are aggregated, so this does not tell us about recent development in this field. In general, these changes are very unfavourable for the environment, because overall energy supply more than doubled and the share of coal, which is much more polluting than oil or gas, increased. The higher share of natural gas is favourable from the point of view of the environment.



Source: Key World Energy Statistics 2014.

Coal resources are immensely big. As concerns oil, there have been several forecasts which predicted the depletion of oil but that has not happened. Newer and newer deposits are discovered.The stock of a certain resource is a function of the level of extraction technologies and price.[51] The Hubbert curve tells us that the extraction of a resource is declining after it peaked. But nobody can tell for sure whether that peak has been reached.

[51] Meaning that deposits which were not profitable to be extracted become profitable with the improvement of technologies and higher prices.

Some decades ago the industry was the biggest energy user. Nowadays in the developed countries households are the leading users, then comes industry and the communal sector is on the third place. The huge energy use of the households is explained by the statistics: the fuel consumption of the cars is an item in household statistics.

Herman Daly, the father of ecological economics has conceived a *sustainability criterion* for the energy sector: It is sustainable, if the newly created renewable energy production capacities can replace the depleted non renewable energies.[52] Studying our diagram we can state that this is a highly theoretical conception which could not be realized. (Practically, the production of exhaustible energy sources should be so lucrative that part of the profit should be earmarked to invest inthe renewable energy production to create that much capacity which could replace the fossil sources. This supposes so extremely high exhaustible energy prices that they would not be depleted.)

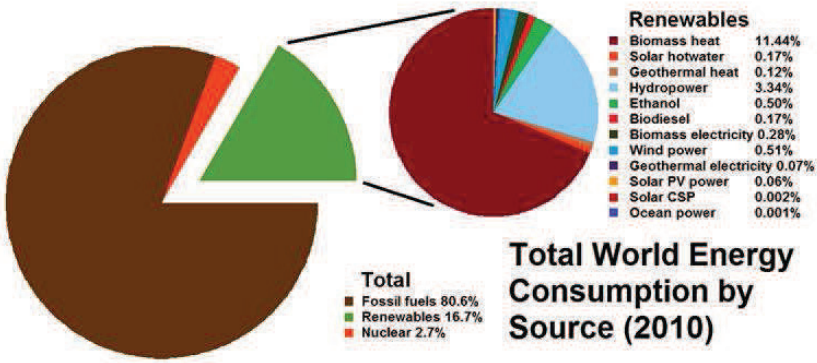
As a result, when non renewable energy production is increasing and the share of renewables stagnates, we may not speak even about the environment friendly character of the energy sector. From the economic point of view, exhaustible energy production should be heavily taxed because it produces very big negative externalities. Butthe opposite is happening. Exhaustible energies are the mostly subsidized products.

The renewables

In 2010 renewables made up 16,7 percent of total world energy consumption. From this biomass for heating (wood) was 11,4 percent and hydropower 3,3 percent. As a result, solar, wind, geothermal and energy of non wood biomass made up *less than 2 percent*.

[52] Daly, Sustainable Growth: An Impossibility Theorem, 1993.

To make energy sector sustainable, components of renewable energies should have a much higher share. Biomass (wood) use has limits which are well defined by ecological economics: we can harvest only the growth; the stock should not be diminished. (This holds true for all elements of the ecosystems, e.g. fish.)[53] We know well those problems as well which are caused by the big hydropower plants: the destruction of the environment, change of the original landscape, raise of underground water level, etc. As a result, a substantial increase should be realized in the production of solar, wind, geothermal energies and fuels and energy from non wood biomass. To put it simply: could the world work on renewables?



Source: Wikipedia

The theoretical capacity of the renewables is very huge. All renewables could satisfy more than 3.000 times the current global energy needs. The bulk of this is solar energy, but wind energy also could satisfy global energy needs 200 times and biomass 20 times. (See table below.) The problem is that given technology levels allow to use only a small fraction of these immensely huge capacities. E.g. solar energy only 3,8 times, wind energy 0,5 time, biomass 0,4 time, etc.

[53] A subtle correction is needed to this definition: it holds true only in the phase where the volume of the biomass is between zero and half.

Renewable energy resources of the world

	theoretical capacity	technically accessible
solar	2,850 times	3,8 times
wind	200 times	0,5 time
biomass	20 times	0,4 time
geothermal	5 times	1 time
wave-tydal	2 times	0,05 time
hydropower	1 time	0,15 time

Source: Renewable energy sources. WBGU-TV Special Series.

The third filter is price. At the given price level of fossil energies the renewables are not lucrative. Only high oil, gas and coal prices make them profitable but the frequent fluctuations in fossil fuel prices make investors cautious.[54] From the economic point of view, the support of renewables (because they create positive externalities) and depriving the subsidies from the fossil energies (because they cause negative externalities) would be desirable. The correction of market distortions would make renewables competitive, in a different measure, respectively.

There are serious physical barriers as well. We cannot make use of all winds of the Earth because it totally transforms / spoils landscape and has an immensely big land use demand. To make use of solar energy similar obstacles emerge:extensive earth surfaces should be covered with solar panels. The construction of nuclear power plants has time and resource limits. We cannot use all arable land for biofuel production. If the total energy demand of the USA was to be satisfied from biomass, its agricultural lands should be six times bigger and there would be no food production.[55]

The world energy consumption was 14 terawatt in 2008, and the nuclear and renewable made less than 3 terawatt of this. By 2050 world population will be 9

[54] No renewable energy investment is profitable when oil price is above 70 dollars per barrel.
[55] Smil, Vaclav: Energia-válaszút előtt. [Energy policy before cross-road] Kovász, 2009 1-4. szám.

billion and extrapolating present trends energy demand will be 45 terawatt. Taking into consideration the physical and economic barriers, the energy without CO_2 emission cannot be more than 10 terawatt.[56] This would result in a tragic acceleration of global warming. To keep temperature increase within 2 degrees Celsius, an 80 percent CO_2 emission decrease is needed by 2050.

Lewis Nathan, professor of Caltech, California has modelled the task. He forecast a yearly 1,6 percent growth in GDP/capita worldwide and a 1 percent yearly reduction in specific energy demand of world economy. According to this scenario global energy demand will be only 28 terawatt. But taking into consideration that global CO_2 emission should be reduced by 80 percent, 26,5 terawatt energy should be produced by nuclear, solar, wind, non wood biomass, geothermal and other renewable energies. This is a mission impossible.

Mission impossible? (the task in terawatts)

year	total energy in terawatt	non fossil energies
2008	15	4
2050 BAU (extrapolated)	45	10
2050 Model of Nat Lewis	28	26,5

Source: Lewis, Natan: The Future of Power and Energy in the World, Caltech, 2004. web

Whenever we speak about sustainable energy use or energy consumption, we should have in mind these figures. From the actual level of 4 TW global non fossil energy use, by 2050 we gradually have to reach the 26,5 TW level. The task seems to be impossible. But technological development may offer possibilities which we could not imagine before. Anyhow, a blind and irresponsible technocratic, technooptimistic approach should not be assumed. We always should count only with the actual possibilities and tailor our policies to them.

[56] Lewis, Natan: The Future of Power and Energy in the World, Caltech, 2004. web

The nuclear energy

To make the energy issue complete, we have to refer to nuclear energy as well. In February and May 2007 the IPCC published its reports on the evident dangers of climate change. Parallel with this *James Lovelock* made urging statements. He suggested that fossil fuels should be phased out as quickly as possible and replaced by nuclear power. Massive investments should be commissioned in nuclear energy production. He criticized the greens as romantic people, because of their atavistic fear of the nuclear energy. According to Lovelock even with a huge change in the energy supply the imminent climate change cannot be postponed but somehow diminished. He suggested an "ordered withdrawal", saving the population and our cultural values.[57]

The hazards of the nuclear power production are well known. The risk of accidents is very low, but if it should happen, the consequences are fatal. A major hazard is the deposition of used nuclear fuel and waste. For the time being no country may say that it has resolved the problem, the safe deposition of spent nuclear fuel. Anyhow, nuclear power production raises less hazards than the climate change. Still, the suggestions of Lovelock were seriously criticised, basically on two reasons. First, investment is very slow, in most countries it needs 8-10 years, due to the sophisticated technology and safety regulations. Second, these investments are very costly and the opportunity cost of phasing out fossil fuels is very high. Given an energy budget of a country, spending on efficiency increase of fossil fuel production and use probably gives better results in climate mitigation.

It is difficult to draw any conclusion regarding the "sustainability" of nuclear power. Personally, I think that the increase of the share of nuclear power in energy use or production is favourable from the environmental point of viewand phasing out fossil fuels totally is unrealistic.

[57] Der Spiegel 5/2007.

Transport[58]

Transport is one of the industries which most heavily pollutes the environment. Its share in the global GHG emission is 14 percent, equal to that of manufacturing. CO_2 emissions originating from transport is increasing. This is contrary to the emission of all other industries in the developed countries, where the opposite trend is happening. A strange and intriguing phenomenon takes place in the developed world, namely, the specific transport demand of the GDP is not decreasing, the two curves go parallel, despite of the fact that services make more than 2/3 parts of the GDP, which are mostly not material intensive, consequently not transport intensive and the transport itself has only a few percentage share in the GDP. At the same time, passenger transport demand increases more quickly than GDP.

Besides air pollution and contribution to climate change, casualties are the third biggest item in damages caused by traffic and transport. Noise, land use and landscape degradation are the further damages. The overwhelming part of these are due to road traffic. While, rail and public transport, are less polluting in specific terms.

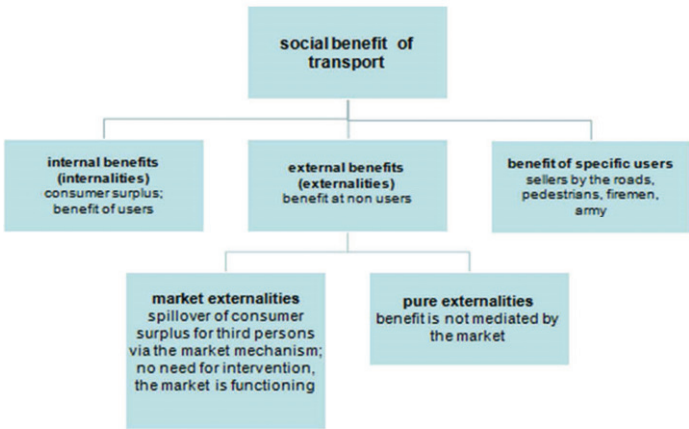
In the developed countries traffic and transport produces environmental and health externalities which equal 5-7percent of the GDP. If we deduct all the budget income (fuel taxes, highway fees, etc.) originating from traffic and transport, we still have a negative social balance, 3-4 percent of the GDP.[59](In countries, where motor fuel is expensive and highway fees are high, the negative balance is smaller, but budget incomes never surpass total costs caused by traffic.)

Transport economists frequently argue that positive externalities, produced by traffic and transport, also should be taken into account. The problem is that no such positives externalities exist in case of road transport – at least of significant volume.

[58] In this section transport (of goods) and traffic (of people) is used alternatively, although the proper naming of this industry would be Traffic and transport.
[59] See e.g. OECD. The Social Costs of Transport: Evaluation and Links with Internalisation Policies by Emile Quinet (no year indicated)

As seen on the diagram (below), part of the benefits are internal, which are consumer surpluses.

An overwhelming part of the external benefits is spillover of consumer surplus to third persons, mediated by the market. Consequently, where the market works, there is no need for government intervention. (According to economics, in case of externalities, the government should intervene; to internalize negative externalities to reduce them or to support cases when positive externalities emerge that social-economic optimum should be reached.) A pure positive externality is, e.g., when somebody just enjoys the spectacle of looking at transport, or the transport is the source of somebody's work as information etc.



Source: T&E 93/6: External Benefits of Transport? Ecoplan March 1993, or CE Delft: Handbook on estimation of external costs inthe trasport sector. Delft, 2008.

Finally, we list the major characteristics of the *environment friendly* transport:

- railways and public transport should be subsidized because their pollution is relatively low and without subsidy they do not reach the social-economic optimum level of their activity
- road transport and air traffic should be charged with higher taxes to the extent they cause negative externalities in the natural environment and human health

- subsidies to road traffic and air traffic should be removed
- fuel taxes (excise and other) should be high enough to destimulate excessive traffic
- motorways should be self-financed by the road fees (as road traffic does not produce positive externalities, budget financing has no grounds)
- any environment friendly transport policy should aim at reducing transport volume.

But this is still not enough to speak about *„sustainable"* transport. It is an ideal state which cannot be realized in practice. Sustainable transport should use fuels only made of renewables. (The task is even bigger with a view on the negative energy balance of biofuels.)Besides, we have the problem of land use of highways and the environmental load of the background industry: car manufacturing.

For the purposes of economic policy, the concept of *„optimal pricing"* of transport gives good orientation: costs should be corrected by the negative and positive externalities and subsidies should be granted or removed according to the presence or lack of externalities or the character of the service: whether it supplies public or private goods.

Manufacturing

To speak about sustainability of manufacturing – in the sense that it should not step over carrying capacity of the biosphere – would be nonsense (as in most cases). But it is meaningful to speak about how manufacturing could be more environment friendly. We should have threeviewpoints.

From the point of technology, the more it is developed and advanced, the less will be the energy and material use of manufacturing.[60] As concerns the output mix, it

[60] But we should not forget about the so called rebound effect (the Jevons paradox); with cheaper and more efficient technology the total demand and supply will increase and they may annul the gains per product.

may be said that the less the products are heavy, the more they are environment friendly. But this is not a general rule. There is a permanent change of replacing metal for chemical materials. Generally, the “ecological backpack” of the chemical components is heavier than that of the metal ones, so the “weight” is not a good environmental indicator.

Lastly, it is very important, what is the function and what is the destination of the manufactured products.If machinery for fossil fuel extraction (especially for coal) has a high share, it is not good for the environment. In contrast to this, a high share of technologies for renewable energy procession is positive. Similarly, if the share of car and lorry manufacturing is high, it is environment unfriendly, while a high scale production of railway carriages and engines is positive, although the specific energy and material intensity of the latter is higher. In chemical industry, the same distinction can be made between heavy chemicals and light chemicals and pharmaceutical products, being the latter less material but more research and knowledge intensive.

Lately, the food industry is one of the most environment unfriendly ones. This is due to the excessive technology use of the food products. They are chopped and cut up, milled, boiled, frozen, stored on special temperature, etc., being all this very energy intensive.

National and local endowments also do matter. Maybe, a country produces energy and material intensive products because it has cheap energy and other mineral resources. But this environment unfriendly product mix turns positive on the global level, if these products are traded in the international change. I.e., comparative advantages also do matter in environment protection.

Agriculture

Different modalities of agriculture have very different environmental impact. The traditional and self-sufficient (or subsistence) agriculture was in complete harmony with nature. The intensive or industry-like agriculture is quite the opposite. Due to

specialization, manure in stock breeding has become a polluting waste, while for crop production artificial fertilizers are used, which are polluting the surface and underground waters. Besides, it massively employs machinery which compresses the soil and the fuel for the machines pollutes the air. An extreme form of intensive farming is monoculture. This causes the heaviest burden on the environment. In monoculture the potential effect of an eventual contamination is very big, as a result, preliminary protection must be also very extensive. This implies the use of huge volumes of all kind of pesticides, herbicides, hormones, antibiotics and different other chemicals and pharmaceuticals. Besides, monoculture animal husbandry is a crime against animals and raises serious ethical questions. Monoculture agriculturereduces biodiversity as well because it eliminates those small pieces of habitat, which exist on the borders of lands with different owners, which are shelter for plants and animals.

Globally, cattle breeding causes as much pollution and environmental destruction as all the road vehicles on the Earth.

Ecological balance of raising up a two year old, 600 kg weight cattle:
Inputs:
2500 litres fuel to produce fodder and cultivate pastures
3,5 tonnes soybean and other grain
600.000 litres water for the fodder production
14.600 litres water for drinking
Byproducts:
3 million litres CO_2 when burning fuel
200.000 litres methane (the physiological „product" of the animal)[61]
14,6 tonnes manure, which pollutes the soil and underground waters
Output: 300 kg meat

Source: Der Spiegel 6/2001

These data are good arguments for vegetarianism. Namely, when we eat only vegetables, due to the lack of food conversion, 4-6 times less arable land is needed to produce our food.

[61] As known, the climate impact of methane is at least 20 times more than that of CO_2.

Besides environmental pollution and ethical problems, intensive agriculture and monoculture raise serious economic problems as well. The productivity of inputs is decreasing. Our table on the next page contains the marginal efficiency of energy input in case of different kinds of farming, in a historical retrospective.

Energy balance of different kinds of farming

Kinds of farming	Energy MJ/ha/year			Ratio	Marginal efficiency
	Input 1	Fossil %	Output 2	2/1	MJ/MJ **
1. New Guinea (wooded hill slope, natural farming)	103	0	1460	14.2	14.05
2. South England (Wiltshire, farm at the beginning of the 1800's)	586	2	7390	12.6	12.28
3. Java (Polinesia, 1970's years, start of techological development)	1079	54	14760	13.6	11.07
4. South India (1955, farm, beginning of the „green revolution") *	3255	58	42280	13.0	7.01
5. South India (the same territory, 1975)	6878	77	66460	9.7	3.47
6. France (bio farming)	8160	N.D.	51500	6.3	2.95
7. Germany (bio farming)	10741	N.D.	66986	6.2	2.24
8. Germany (integrated farming)	11882	N.D.	63360	5.3	1.92
9. France(integrated farming)	16658	N.D.	59000	3.6	1.25
10. France (intensive farming)	21388	N.D.	62000	2.9	0.88
11. Germany (intensive farming)	21498	N.D.	83710	3.9	0.87
12. South England (Wiltshire, farm in the 1970's)	21870	99	44890	2.1	0.85

* Initiated by the FAO.

** Energy yield of increasing one unit of energy input.

Source: Ángyán – Menyhért: Zöld Belépő, Nr. 9, pp. 69 and 70

The results are astonishing. In case of natural farming, when no chemicals and machinery were used, one additional unit of energy input resulted in more than 10 unit of output (in terms of energy). While, in case of intensive farming, this ratio is below 4. Consequently, marginal efficiency is below 1, the return of investing one more unit of energy is negative. The same holds true, when we examine marginal

returns of fertilizers, or consider the yield in protein of grain production. In the most intensive kinds of agriculture, the productivity of fertilizers and other inputs is decreasing.[62]

A question inevitably arises: how can these kinds of farming still function? We find the explanation in the heavy subsidization of agriculture in Europe.[63] The solution is bio farming, removing subsidies and returning to extensive farming. In chapter III, elaborating on agriculture in the European Union I was dealing with the changes in the subsidy system.

The organic or bio farming minimizes the use of chemicals and replaces machinery with labour as much as possible. It uses the characteristics of the different plants and animals and the physiological interconnections between plants and pests, plants and plants. (Namely, some plants deter pests and defend others against those pests, or some animals defend plants against certain pests.) Integrated agriculture isin between the intensive and the organic. It uses controlled amounts of chemicals and machine force.

How could we shortly formulate the characteristics of sustainable agriculture?

- All the subsidies, aiming at production increase and export stimulation, should be removed. This would result in intensive farming becoming unprofitable.
- Organic and bio farming should be subsidized on the grounds that they produce positive externalities in agriculture, landscape preservation, biodiversity,job creation, keeping local population in villages, conserving values of country life, etc.
- The removal and reorientation of subsidies would make biofuel production also unprofitable. But energy plantation and using agricultural waste for fuel would be lucrative.

[62] Ángyán – Menyhért: Zöld Belépő Nr. 9/1997.
[63] In Hungary, roughly half of the agricultural subsidies are harmful for the environment, they produce negative externalities. See Kiss Károly (ed.) Tiltandó támogatások [Harmful subsidies], p. 30.

Consumption

Environmental NGOs rightly began to emphasize in the 1990's and even before that a priority field in the environment protection should be consumption. Since that the concept of "environment friendly consumption" has been coined; and scientifically falsely but with high marketing value the "sustainable consumption".

In 2012, on its Rio+20 Conference the UNEP has formulated sustainable production and consumption this way: they are sustainable if they remain „within the carrying capacity of ecosystems by addressing and, where appropriate, delinking economic growth and environmental degradation through improving efficiency and sustainability in the use of resources and production processes; and reducing resource degradation, pollution and waste".[64] This contains the most important element of sustainabilty, namely, both production and consumption should remain within „the carrying capacity of ecosystems" and how to achieve this goal. Theoretically this is all right. But how can we measure the fulfilment of this criterion? Of course, we cannot. As it was said at the beginning, sustainability is a global concept and the question, whether we remain within the carrying capacity of the ecosystems or not, is a function of whether there appear irreversible processes in the ecosystems or not. As it is well known, there are a lot of irreversible processes on the global level.

But we can measure concretely the environmental load of a person, of an industry or of a country. (As it was explained earlier, it has no sense to compare this load to the biocapacity of the given surrounding, because on a higher level both the loads and the capacities aggregate and compensate and what does matter, is the difference on the global level.

By now methods of measuring environmental load by ecological footprint calculation of anything and on any level have been developed. Still, I have implemented another method. Namely, in a research aiming at the environmental

[64] http://www.unep.org/rio20/About/SustainableConsumptionandProduction/tabid/102187/Default.aspx

load of consumption in Hungary, I substituted the energy and material content of consumption for environmental load and used the technological coefficients of input-output tables of the years 1991, 1998 and 2005.[65]

I am not reproducing the characteristics of consumption in Hungary, only the general conclusions valid for any country. (Of course, these characteristics are affected by the Hungarian price, tax and subsidy systems.)

- The most energy and material intensive sorts of consumption are food, traffic and household energy, in this order, the less intensive ones are telecommunications and education.
- It cannot be stated in general that services are environment friendly because they are more and more "tool-related" activities. Leisure, sports and culture are ranking in the medium field – not to speak about traffic.
- This holds true for the health as well, because half of the health consumption is made of medicines.
- In the 20 year long period (1990-2009) under examination the volume of consumption increased by 29 percent. Still, the environmental load of this consumption did not change. This is explained by the structural changes within consumption: the share of the energy and material intensive sorts declined while the more environment friendly kinds increased.

[65] Kiss Károly: [Examining the environmental load of Hungarian households], 2012. Of course, energy and material use do not make the whole environmental load (e.g. land use and the pollution of environmental elements are not included) but there are no perfect methods. Footprint calculations suffer from other insufficiencies.

Energy and material content of consumption in Hungary, calculated on the basis of technological coefficients of input output tables

consumption categories	**aggregated coefficients**		
	1991	**1998**	**2005**
01. food and non alcoholic beverages	0,619	0,627	0,656
02. alcohol, tobaccoand drugs	0,568	0,591	0,529
03. clothing and footwear	0,338	0,373	0,622
04.1, 04.2, 04.3 house rents and similar services	0,197	0,120	0,134
04.4 water and other services.	0,424	0,303	0,272
04.5 household energy	0,744	0,502	0,558
05. furniture and household equipment	0,442	0,466	0,542
06. health	0,361	0,352	0,374
07. traffic and transport	0,598	0,620	0,685
08. telecommunications	0,185	0,134	0,087
09. leisure and culture	0,411	0,478	0,447
10. education	0,166	0,094	0,077
11. catering and hotels	0,140	0,247	0,314
12. other products and services	0,228	0,157	0,062
investment in housing	0,299	0,318	0,338
consumption categories	**ranking** (high→low energy and material content)		
01. food and non alcoholic beverages	2.	1.	2.
02. alcohol, tobacco and drugs	4.	3.	6.
03. clothing and footwear	9.	7.	3.
04.1, 04.2, 04.3 house rents and similar services	12.	14.	12.
04.4 water and other services.	6.	10.	11.
04.5 household energy	1.	4.	4.
05. furniture and household equipment	5.	6.	5.
06. health	8.	8.	8.
07. traffic and transport	3.	2.	1.
08. telecommunications	13.	13.	13.
09. leisure and culture	7.	5.	7.
10. education	14.	15.	14.
11. catering and hotels	15.	11.	10.
12. other products and services	11.	12.	15.
investment in housing	10.	9.	9.

Source: Kiss Károly: [Examining the environmental load of Hungarian households], 2012, pp. 7-28.

Consumption in the developed countries by no means could be called sustainable. However, a structural change within consumption towards the less energy intensive sorts, namely telecommunications and education, may mitigate the increasing environmental load of the consumption boom.

The immensely big waste flows are not halted by recycling. Recycling may cause even worsening because it narcotizes consumer consciousness, that with recycling the problem is solved and no direct waste reduction is needed. The sewage problem has an environment friendly solution mainly by individual waste treatment in family house districts.

Other industries

A marked trend has begun in the construction industry for years, namely that of *passive houses*. These houses maximally exploit the energy of sun, wind, the rain water and the natural conditions (slope, exposition, etc.). They produce light, heating, hot water and process manure and sewage in an environment friendly way. If they can do without additional fossil energy, they are really sustainable.

Another very important endeavour is the improvement of *energy efficiency of buildings*. In Hungary, e.g., heating of air for 1 m^3 of a house or flat needs 1,5-2 times more energy than in Germany. Insulation of old buildings pays off very well. In Germany for sellinga house or flat an energy licence is needed which contains the energetic characteristics of that house or flat. In the European Union funds are available to finance the improvement of energy efficiency of buildings. It is characteristic that fossil fuel producers and sellers are compelled to take part in financing. The argument for this is that they get free allowances to CO_2 emission.

A third way of improving environmental characteristics of construction industry is the *reuse of building debris*. In our consumer societies buildings are treated more and more as objects of mood; if the owner does not like them, they are demolished and a new building is erected. The building debris makes enormous volumes, while

contains very valuable materials and components for reuse. In Germany there is a compulsory rate to reuse building debris.

Since years, we frequently hear about *"sustainable tourism"*. It tries to ease the huge environmental load and damage caused by mass tourism in different ways. E.g., it does not direct masses to ecological sensible areas. Instead of private car use it propagates availability by bike or train. It persuades hotel guests that towels should not be changed daily.

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My friends, love is better than anger. Hope is better than fear. Optimism is better than despair. So let us be loving, hopeful and optimistic. And we'll change the the world.
Jack Layton

Improving the Path toward Environmental Sustainability

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ABSTRACT: This paper first discusses what we have learned during our various generational efforts toward environmental sustainability. It then discusses the errors we have made in applying what we have learned and proposes a better way forward for organizations intent on becoming sustainable.

Foreword

Owing to the background of the author, this discussion focuses on the environmental aspects of sustainability and the following discussion is based, in a large part, by this author's experiences working as an environmental professional in the United States.

The term, "environmental" is used here to represent a subset of the broader concept of "ecology", referring to that portion in which our species interacts with its supporting ecosystems. Thus the term, "environmental sustainability" is used in reference to this subset.

I. Lessons of the Past

Decisions we make and actions we take are in part, a result of the meanings and understanding that we as a society hold in common. So, in order to look at the evolution of this concept of sustainability in the private sector, it is essential that we have some understanding of what was meant at different times when decisions were

made or actions were taken to move us in this direction. It is important to learn from history. This has value not only as a means to provide context for decisions of the past but for guiding our path moving forward.

The concept of "environmental sustainability" might be viewed as the most recent and perhaps most sophisticated step in a sequence of environmental movements. It represents perhaps the fourth generational phase of environmentalism in the US. Considering the substantive ignorance of our relationship with the ecosystems that support us, it is perhaps fitting that our progress follow such a sequential path and that we attempt to capture and engage the lessons of the past in our efforts to move toward a more sustainable future. The following discussion attempts to characterize each of the three preceding generations and extract key lessons learned relevant to this concept.

First Generation

The *first generation* of environmentalism in the United States was known as the "American Conservation Movement". It originated and grew during the 19th and early 20th centuries with stalwart and tremendously effective supporters like Henry David Thoreau, George Perkins Marsh, John Muir, U.S. President Theodore Roosevelt and others; its focus was on the value to humans of natural wilderness, perhaps characterized best in 1901 by Muir's avowal:

> *Climb the mountains and get their good tidings.Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves.* [66]

Muir was strongly influenced by Thoreau who a half century earlier argued that we should hold a reverence for nature and feel a sense of awe when we take from nature to serve our needs.[67] Roosevelt, who was an avid hunter and initially concerned that

[66] John Muir, *Our National Parks*, Houghton, Mifflin, 1901, page 56.
[67] Henry David Thoreau, *Walden,* Oxford University Press, 1997, page 332.

there was a need to protect game species from extinction in the US, later came to recognize that our natural resources were not inexhaustible[68] and then helped to institutionalize the conservation movement by dramatically expanding the US national park system and increasing US forest reserves. In his book *Man and Nature*, Marsh warned of the perils of environmental degradation and professed an interconnectedness of all forms of life:

> *All nature is linked together by invisible bonds and every organic creature, however low, however feeble, however dependent, is necessary to the well-being of some other among the myriad forms of life.*[69]

In 1938, *American Forests Magazine* published an article entitled, "Why wilderness?" by Sigurd F. Olson, an American author and environmentalist, declaring that, ". . . hidden back there in the country beyond the steel and the traffic of towns is something real, something as definite as life itself, that for some reason or other is an answer and a challenge to civilization."[70] He speaks of this as something beyond the rejuvenation associated with Thoreau's pond and more akin to the wilderness experiences described by Joseph Conrad and Jack London. He describes a transformation that many individuals go through when stepping out of civilization and into an unconquered environment, one in which there is an element of fear of the unknown, and of the related "old stimulus which only the unknown could give." He remarks on the quickness with which individuals adapt to the wild and of the infallibility of the "wilderness formula" in achieving this transformation. He attributes the ease of this transformation to our genetic memory – "things long forgotten and needing only the rejuvenating experience of actual contact to bring them back."

Whether wilderness is identified as a remote pond or a frozen tundra, the experience of being there is notably different than that of life in a town or city. Standing at the

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[68] Theodore Roosevelt, *Seventh Annual Message to Congress, December 3, 1907.*
[69] George Perkins Marsh, Man and Nature; or Physical Geography as Modified by Human Action, Harvard University Press, 1864, page 90.
[70] Sigurd F. Olson, "Why Wilderness?", *American Forests Magazine,* September 1938.

top of a mountain or at the edge of a sea can bring a clearer sense of perspective, a balance, and a release from stress. Interaction with unconquered elements of nature can reward the participant with a sense of exhilaration.

This generation of environmentalism, which may additionally be called the "Land Preservation Era", focusing on proper use of land resources and the importance of maintaining natural places, continued into the mid-20th Century.

Clearly, the most essential elements of the first generation philosophy are the recognitions that: 1. all living things are connected and that we consequently threaten ourselves by degrading our environment; and 2. wilderness and natural places are necessary for a healthy human spirit, for recharge and rejuvenation. While neither of these elements appear obvious in today's thinking regarding sustainability, both are prerequisite to environmental sustainability.

Second Generation

A *second generation* of environmentalism in the US was conceived when in 1962 Rachel Carson, who had spent 15 years working for the United States Fish and Wildlife Services, wrote *Silent Spring*, a book that is credited with initiating this second environmental movement. Carson's message is implied inherently in the opening paragraph of her book.

> *The history of life on earth has been a history of interaction between living things and their surroundings. To a large extent the physical form and the habits of earth's vegetation and animal life have been molded by the environment. Considering the whole span of earthly time the opposite effect in which life modifies its surroundings has been relatively slight. Only within the moment of time represented by the present century has one species acquired significant power to alter the nature of the world.*[71]

[71] Rachel Carson, "Obligation to Endure", Chapter 2, *Silent Spring*, First Mariner Books, 2002.

Carson revealed to the public that large amounts of chemicals were being introduced into the environment every year. She focused particularly on organic chemicals and specifically on pesticides. Her claim was that their widespread use was causing earth to become unfit for life. Her recommendation was that biological alternatives to chemical pesticides be explored.

She expanded the field of concern beyond the inorganic compounds (e.g., arsenic bearing pesticides), to include organic compounds and identified chlorinated hydrocarbons and organophosphates as the main problem leading to bird and fish kills. Her work pioneered the exploration of the possibility of surface and groundwater contamination as a result of leaching, runoff and direct spraying. She explained that water treatment plants did not adequately remove these chemicals. Carson introduced the concept of delayed physiological symptoms as a result of exposure to these chemicals and used pesticides as a symbolic example to present the view that our continued efforts to master nature through technology would result in dire consequences.

The debate that ensued molded the framework of environmental management as the work of this second generation of environmentalism. It has taught us to ask questions about the ultimate fate of chemicals we introduce into the environment. We've learned that certain compounds can exist for many years, can be transported globally and can accumulate in living organisms. Her work spurred the development of more sensitive and chemical specific detection equipment. It was the beginning of a reversal of the logic that viewed the Earth as a sink capable of absorbing and recovering from any amount of contamination.

This was an extremely difficult change for us to make, since the original logic was in fact based upon our long-standing observation that the Earth could, in fact, accommodate our wastes, albeit when human population was smaller and less dense, and long before the unfettered growth, use and disposal of synthetic chemicals for which no natural enzymes exist.

Though originally conceived in 1962, this second generation, perhaps most appropriately dubbed, the "Pollution Control and Cleanup Era", took another eight years to become obviously visible to the public eye and was ceremoniously launched on April 22, 1970 – the first Earth Day.

> *The efforts of the two decades that followed produced substantial environmental quality improvements across the US and dramatically expanded the base of knowledge of environmental impacts. Issues of responsibility and accountability were brought to the forefront during this time by a series of environmental calamities both here [in the US] and abroad. Ultimate disposition of waste materials became established firmly as the responsibility of the generator and waste-generating organizations came to realize that compliance with current environmental laws might not suffice to protect their assets against related future liabilities.*[72]

The important and very necessary clean-up efforts of this second generation thinking almost completely eclipsed earlier sentiments of the US public regarding land preservation and the spiritual rejuvenation of natural places. Popular environmentalism became focused on pollution, hazardous waste, and national "Superfund" sites. While much was gained, much was also lost.

By the early 1970s, leaders in government, industry and the public were enmeshed in identifying and debating the issue of what should be an appropriate balance and distribution of roles and responsibility for protection of the environment. For industry, discussion was confuscated by its need to remain competitive and profitable. It soon became clear to the private sector and others that while this responsibility could not be ignored by industry, it also could not met in any equitable way without the existence of a baseline of national standards.[73] Herbert Doan, then president of Dow Chemical argued that it was not the responsibility of the private

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[72] John Morelli, *"History and Evolution of Environmental Management in the U.S."*, Chapter Two, *Voluntary Environmental Management: The Inevitable Future,* Lewis Publishers, 1999, page 9.
[73] John T. Middleton, "A Fresh Opportunity forIndustry." *ES&T* 1, No.3, March 1967.

sector to determine what constituted acceptable levels of environmental performance and proposed a distribution of responsibilities in which the public would identify environmental priorities, government would establish corresponding legislation and regulations, and industry would operate within these legislated boundaries. There was also considerable skepticism by government regulators regarding the ability of the private sector to voluntarily take on this responsibility. This coincidence of thought led to a decade of promulgating new environmental laws and regulations.

The "command-and-control" approach of the US in its efforts to protect the environment differed from that taken by many other countries in which a more collaborative approach was pursued. Setting aside the issue of how appropriate or inappropriate this approach was at the time it was initiated, or later as environmental protection became integrated into the fabric of US society, the initial value of these efforts cannot be overstated. Legislation pushed environmental concerns onto the table in every corporate boardroom and the investment in research by both public and private sectors to determine just what did or did not constitute appropriate levels of environmental quality and performance resulted in a dramatically expanded body of knowledge regarding the interaction of human activities and the environment.

The key lessons of the second generation included: 1. a reversal of the logic that viewed the earth as a sink capable of absorbing and recovering from any amount of contamination; and 2. creation of an extensive body of knowledge regarding the interaction of human activities and the environment.

One might argue that recognizing the earth as incapable of absorbing and recovering from unlimited pollution is the most profound and perhaps one of the very few relevant things that we really learned in the last half-century. It is perhaps the first half of a two-part recognition; the second – though not yet completely learned – being that the supply of material, environmental, and conventional energy resources are not limitless. Both understandings are foundational to environmental sustainability.

Third Generation

By the early 1990s, corporations were beginning to recognize that improved environmental performance could reduce liability and, in fact, could increase profitability. The 3M Corporation supported its slogan, "Pollution Prevention Pays", with documented evidence of its avoided costs.[74] This thinking stimulated other leaders of industry and moved us towards a *third generation* of environmentalism which might be characterized as "The Era of Voluntary Environmental Responsibility". Considering the fact that "voluntary" actions are still principally driven by strong and enforceable regulations in the US, this generational title is somewhat of a misnomer. However, by this time the private sector had accepted environmental performance as a legitimate and necessary business responsibility and, as with other elements of business, had begun to invest in improving the effectiveness and efficiency of its efforts in this regard.

In response to the 3M testimonials and in recognition of Benjamin Franklin's axiom that "an ounce of prevention is worth a pound of cure", industry began to move its environmental protection related efforts upstream from properly managing its wastes to reducing the amount of waste it generates. While this moved us somewhat towards recognition of the finiteness of resources, industry's principal motivation was to reduce the costs associated with managing waste, and thus it missed the more essential purpose of reducing resource use. Regardless of the motivation, industry began to make the connection between its environmental performance and its future success in the marketplace.[75]

In 1993, Paul Hawken wrote *The Ecology of Commerce*[76], which was directed at and influenced many in the private sector. In it, he identified basic issues of business relating to sustainability, or the lack thereof. He argued that business extracts

[74] Thomas W. Zosel, "How 3M Makes Pollution Prevent Pay Big Dividends", *Pollution Prevention Review,* Winter 2990-91 pages 67-72.
[75] "Environmental Issue Management Moving to Heart of American Business Policies; New study profiles insight on corporate attitudes." *Financial News*, October 30, 1990
[76] Paul Hawken, The Ecology of Commerce: A Declaration of Sustainability, HarperBusiness, 1993.

resources in harmful ways; uses energy, material, and environmental resources inefficiently; and produces products in a manner that results in the generation of an extraordinary amount of waste. He contended that in order to survive, we would have to learn to live within our own ecological niche, recognizing that there are carrying capacity limits and that our understanding regarding the complexities of the world and its ecological systems is incomplete and insufficient.

> *Respecting limits means respecting the fact that the world and its minutiae are diverse beyond our comprehension and highly organized for their own ends, and that all facets connect in ways which are sometimes obvious, and at other times mysterious and complex.*[77]

Hawken explained that the "invisible hand" of the marketplace will not work under the condition where the producers do not bear the full costs of production, including pollution and environmental damages.[78] He argued that in a restorative (Pigovian) economy, since full responsibility and true costs would belong entirely to the producer of waste, the producer would have an incentive to stop wasting and start recovering resources. In such an economy all producers would be held responsible for environmental costs and the costs of environmental damage would therefore increase the cost of production so that the producers most successful at reducing waste would have the least environmental costs and be most competitive.[79] His approach was not to institute more restrictions on business but rather proposed revising our economic system to recognize the true, full costs of doing business; to reward companies that internalize their true costs; and to make the cost of destroying the environment exceedingly high.

The key lessons of the third generation of environmental management (learned but certainly not all accepted or practiced) included: 1. environmental performance needs to be considered a legitimate and strategic part of doing business; 2. society

[77] Hawken, pages 33 & 35.
[78] Hawken, pages 75 & 82.
[79] Hawken, pages 83, 87, 90.

must learn to live with its ecological niche; 3. economic systems must respect ecological limits and recognize that all ecological facets are connected in ways beyond our comprehension; 4. producers need to be held responsible for the environmental cost associated with their activities, products and services; 5. in a restorative economy the most competitive producers will be those with the least environmental costs; and 6. that the approach need not be to institute more restrictions on business but rather revise our economic system to recognize the true cost of doing business.

And thus, in this third generation, we note similarities with the concerns and sensitivities expressed in the first generation. We begin to come full circle in this k thinking. These pieces are essential building blocks of sustainability.

II. Errors of the Past

It is as important to avoid the mistakes of the past as it is to capture what we have learned. In identifying mistakes it is important to recognize that, owing to our understandable ignorance when moving forward into a new area of understanding, making some mistakes is inevitable. While precaution is prudent when moving into the unknown, paralysis can be worse. It appears that many of our errors were made as a result of the narrowness of our focus at the time. Urgency sometimes forces us to limit our perspective. Interestingly, the concept of sustainability, or more specifically, environmental sustainability, demands the broadest perspective. It certainly demands much more than can be corrected with a single piece of legislation or a quick technological fix. Rather, it demands a significant cultural shift; a shift in values, ethics, and mores – basically, a change in the way we relate with the world we live in.

The following discussion attempts to identify the key mistakes we have made in our efforts thus far toward environmental sustainability.

Errors of Comprehension

The Ragu Syndrome

There was a television advertisement that ran for a few years in the US for a commercial brand of pasta sauce called Ragu. In it, a comparison was made between the product being sold and traditionally homemade pasta sauce. The advertisement flipped back-and-forth between two scenes. In the first an older Italian woman was shown in her kitchen adding various ingredients to the pot. In the second, a jar of Ragu pasta sauce was shown sitting on a table. The narrative accompanying the first scene explained that the woman was adding a particular ingredient, say garlic or basil. The narrative accompanying the second scene said simply, *"It's in there"*. The intended implication was that you did not need to go through all this work to prepare the sauce when you could easily buy it in a jar, already prepared. Less obvious was the implication that you do not need to know what each ingredient is, how much is needed, or how it contributes to the creation of a successful pasta sauce. Reliance on the belief that *"It's in there"* is hereby dubbed the *Ragu Syndrome*.

Environmental regulations are perhaps necessary in society but without an understanding of why they are written in the way they are or how they contribute to protecting the environment, they can sometimes create more problems than they avoid. The difficulty is that it is impossible to write a regulation that covers the infinite variety of actions that a regulated corporation or individual might choose to take, and thus in many (perhaps most) cases, interpretation is necessary. Without knowing why an action is permitted or prohibited by the law, it becomes difficult to apply a specific provision or restriction to an action that is similar but not necessarily equivalent to one specified in the regulation.

Environmental regulations in the US are restrictive, quantitative documents which specify what is and what is not permitted. There simply are no qualitative elements that explain why this is so or how it will protect the environment. The implication is that *"It's in there"* – i.e., if the regulations are complied with, the environment will

be protected. The result is that industry and other members of the regulated community are provided with no useful foundation upon which to construct an appropriate action for something not directly specified in the regulation. Sadly, this *Ragu Syndrome* limitation also exists for regulatory experts in government and consulting. As a consequence, new actions are often unjustifiably approved, delayed, prohibited, overregulated, or under-regulated on the basis of educated (not always) guesswork.

Ecological Efficiency vs Ecological Effectiveness

> *Eco-efficiency is an outwardly admirable and certainly well-intended concept, but, unfortunately, it is not a strategy for success over the long term, because it does not reach deep enough.*[80]

If in 1970, an environmentally minded individual walked into an industrial manufacturing facility and asked the operations staff to reduce the company's waste emissions to zero percent, there probably would have been a slight speechless pause followed by some muted laughter and then the company security officer would have be called to escort the individual to the exit. The request would have appeared ludicrous to the operations staff because a zero emissions outcome was well beyond their conceptual horizon.

Societal perceptions about and consequent practices affecting the environment might be said to evolve under the precepts of symbolic interactionism, i.e., the environment-related decisions that we as individuals make are influenced by meanings held in common by our society and those meanings are in turn influenced and reformed by our individual decisions.[81] We might thus envision ourselves standing upon social reality platforms, reflective of our current perceptions of the

[80] William McDonough and Michael Braungart, "The Next Industrial Revolution, *The Atlantic*, October 1998, http://www.theatlantic.com/magazine/archive/1998/10/the-next-industrial-revolution/304695/, accessed 4 October 2015.
[81] John Morelli, ISO 14000: A Catalyst for Reinventing EPA, UMI, May 1997, page 56.

environment from which we can view a horizon beyond which exists a vision of true environmental sustainability.

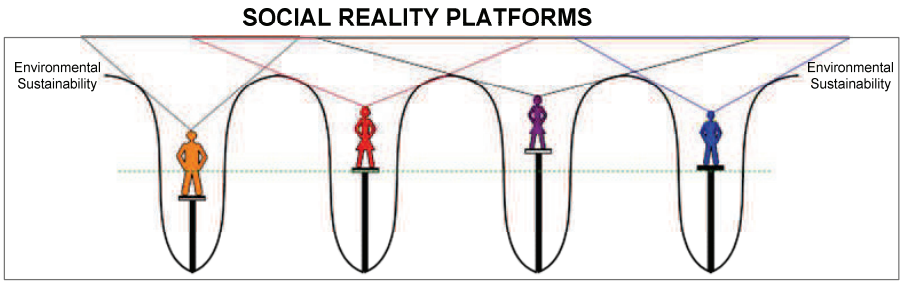

Figure 1 - Social Reality Platforms

As we, through our decisions and actions, continue to elevate the platforms upon which we stand, we broaden our horizons and move closer to envisioning and achieving an environmental sustainability reality.

It is thus understandable that given the obstructed views from our respective social reality platforms at some particular point in time, decisions made might focus on the symptoms we can see rather than on their underlying causes. This may have been the case regarding, and the cause of our obsession with, "eco-efficiency".

The goal of eco-efficiency, as introduced in 1990 by Schaltegger and Sturm and then subsequently promoted by the World Business Council for Sustainable Development, was to increase corporate profitability while decreasing resource use and environmental impacts.[82] While its practice is still popular and generally considered successful in reducing the overall amount of resources used to produce a product, eco-efficiency alone is not a strong enough concept to get us to environmental sustainability.

> *Despite all this good work, we still must face a sobering fact. If every company on the planet were to adopt the best environmental practices of the "leading"*

[82] Stefano Pogutz, Valerio Micale and Monika Winn, "Corporate Environmental Sustainability Beyond Organizational Boundaries: Market Growth, Ecosystems Complexity and Supply Chain Structure as Co-Determinants of Environmental Impact", *Journal of Environmental Sustainability*, Vol. 1, Issue 1, 2011.

companies . . . the world would still be moving toward sure degradation and collapse. Paul Hawken, 1993.[83]

Three years after the concept of eco-efficiency was introduced to the world, Hawken suggested that if "the world's most intelligent managers cannot model a sustainable world, then environmentalism as currently practiced by business today, laudable as it may be, is only part of an overall solution".[84] He argued that we have a basic problem with the design of our businesses framework. Eco-efficiency is insufficient in that it is designed to work within the existing business framework and while it may reduce resource use, it focuses only on resource use relative to production and does not address absolute measures of impact. So, in essence it only slows our movement toward destruction rather than redirecting it toward sustainability.

Errors of Design

Focusing on a narrow slice of a broader goal can lead to results that miss the target while deluding us into believing we are on the right track. The following examples are provided to illustrate such errors.

Refrigerator Lifespan, Resource Use and Energy Efficiency.

The first self-contained refrigerator was introduced in the US by the Frigidaire Company in 1923. Since then it has evolved in many ways, most noticeably perhaps with respect to energy efficiency. While today's refrigerators may be as much as 65% more efficient than those produced 40 years ago[85], the lifespan of these appliances appears not to be what it used to be. Refrigerator manufacturers competing fiercely to increase their market share, reprioritize their design standards to make their products more attractive to potential consumers. Energy efficiency probably tops the list of design priorities from a marketing point of view. Not only

[83] Paul Hawken, *The Ecology of Commerce*, HarperBusiness, Preface, page xiii.
[84] Hawken, page xiii.
[85] "Average Household Refrigerator Energy Use, Volume and Price Over Time", Refrigerator Graph, Appliance Standards Awareness Project, 2011, http://www.appliance-standards.org/content/average-household-refrigerator-energy-use-volume-and-price-over-time, accessed 18 August 2015.

are consumers looking to minimize energy costs but the US Department of Energy provides 300 million USD annually in rebate incentives to consumers who purchase energy-efficient appliances. Additionally, since 1976, US refrigerator manufacturers have been mandated to comply with increasingly more stringent governmental standards for maximizing energy use and while the law of diminishing returns appears to apply (i.e., approximately 80% of the increases in energy efficiency occurred prior to 1992), manufacturers continue to take measures to maximize the energy efficiency of their products. One strategy for doing so is to minimize the size of the electric motor. One of the consequences of employing this strategy is a reduction in the life of the appliance. Whereas it was not uncommon in the past for refrigerators to last 20 years or more, new models are estimated to last about half that time. Energy efficiency is good; it uses less electricity, and it saves consumers money, but what will be found if we step back to broaden our perspective and conduct a comprehensive and comparative lifecycle assessment of this appliance? Such analysis does not appear to be available. Whether or not the overall analysis will result in an overall benefit, it seems essential that we should be aware of the full energy, material, and environmental resource costs associated with the need to produce two refrigerators in place of one, and to know also, just who is paying these costs. It appears likely that at least some of the resource depletion costs are not covered but rather are being passed on to future generations.

Automobile Brake Shoe Replacement

Similar to the situation with refrigerators and energy efficiency, automobile manufacturers compete for energy efficiency in the form of highest miles per gallon or kilometers per liter. Fuel use is directly related to work done and the work of moving a heavy vehicle is therefore greater than the work involved in moving a lighter vehicle. One strategy for reducing the weight of the vehicle is to minimize excess material used in the construction of vehicle parts. Disk brakes are composed of a rotor, brake pads, and a mechanism for applying pressure to the pads so that they engage the moving rotor and through friction slow the vehicle. The brake pads

are designed to wear with use and eventually need to be replaced. Brake rotors are made of harder materials and consequently wear more slowly and do not have to be replaced until they are worn down to some designated "discard thickness". In the past, brake pads would be replaced on a vehicle much more often than rotors. In fact, rotors were thick enough that if they were scored by brake pads that were worn down to the rivets that held them, the rotors could be turned on a machine lathe to smooth their surfaces. Today, in an effort to reduce weight and therefore increase fuel economy, rotors now weigh only 20% or 25% of what they used to weigh. They are designed to survive only one set of brake pads.[86]

Again, we should ask whether the energy saved by reducing the weight of the brake rotors is more or less than the energy required to manufacture and replace them multiple times. As before, we should also consider the impact of additional resource use, the cost associated with such use and who ultimately will pay this cost.

Errors of Approach

Command-and-Control

The US chose to use a command-and-control framework in its approach to the development of environmental regulation. In such a framework, standards tend to be developed and applied uniformly across groups of potential polluters.[87] This choice reflected an initial thinking that all businesses were polluters and therefore criminals. As stated earlier, it is now generally accepted that the outcome was successful, at least initially. As US organizations began to integrate environmental management into their infrastructure and improve their environmental performance, the rigidity of this approach sometimes inhibited innovation and consequently opportunities for unprecedented improvements in environmental performance were missed. It took a while before there was any kind of recognition of exemplary environmental

[86] "Braking in Green Bay? Why it seems like you need new rotors every brake service", *AutoSelect*, 11 November, 2013, http://www.autoselectonline.com/article/why-it-seems-like-you-need-new-rotors-every-brake-service, accessed 18 August 2015.
[87] Scott J. Callan and Janet M. Thomas, *Environmental Economics & Management: Theory, Policy and Applications,* Cengage Learning, Page 93, accessed 19 August 2015.

performance on the part of some of the more environmentally progressive organizations. This initial approach set the "flavor" for interactions with the US Environmental Protection Agency and when the Agency offered to put forth a more flexible form of regulation, that opportunity was ignored by many who felt that it would be too difficult to negotiate with an agency so enmeshed in command-and-control strategies.

For example, during the development of its landfill design regulations during the 1980s, the Agency put forth three alternatives for public consideration: 1. a single design standard all landfills; 2. a numbered set of design options; and 3. a performance-based design standard. Not surprisingly, environmentalists preferred the one standard design because it would leave less open to interpretation and thus, they believed, there would be less opportunity to circumvent the intent of the regulation. Interestingly, both environmental professionals and industry constituents favored having a numbered set of design options. This was surprising at the time because, from an engineering perspective, it would make more economic sense to have a performance-based standard in which the design would correspond to a specified use for that landfill (e.g., municipal solid waste, construction and demolition debris, ash and inert combustion waste, etc.). The reason behind their support for this alternative option was that they believed it unlikely that the economic benefit of a use-specific, performance-based design would outweigh the additional costs associated with the effort necessary to convince the Agency that the design would perform to its satisfaction.

Uniform standards have their uses and perhaps are appropriate at certain points in time but they do tend to prevent development of a depth of knowledge associated with the thing they are regulating. If an organization is required to design, build, and operate a facility in a given way regardless of the specific situation being managed, there is little or no opportunity for it to develop, understand and contribute to the related knowledge base.

Errors of Off-Target Goals

The Illusion of Corporate "Environmental Goals"

There is ample evidence in the literature by Chan[88], Ionescu-Somers[89], Rothenberg[90] and others indicating that above and beyond all other pursuits, achieving regulatory compliance is the primary and principal role of the environmental manager working in industry. Butler identifies five "operational goals" of the environmental manager working in industry to be: regulatory compliance, reducing environmental costs; effectively communicating environmental performance; reducing the corporation's environmental liability; and augmenting the company's efforts to increase its stakeholder, or shareholder, support.[91] [Note: as used here, "operational goals" can be considered the everyday, current goals and activities of the environmental manager performed in service to the company.] More specific "environmental goals" of business might be to: increase market share, penetrate new markets, recover from legacy problems, meet market expectations, generate good will, reduce environmental liability, reduce insurance premiums, improve employee morale, satisfy organized labor concerns, retain current customers, increase company loyalty, improve community relations, reduce regulatory fines and fees, satisfy employee concerns, and conform to industry standards. While these are all certainly legitimate corporate goals, they are in fact business goals -- not environmental goals.

Interestingly, pursuit of these goals can, in fact, produce positive environmental results. Following the implementation of actions taken toward meeting three of these

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[88] K. K. Chan, C.M. Tam, Vivian W.Y. Tam, and S.X. Zeng, "Environmental performance measurement indicators in construction," *Building and Environment*, 41 (2006): 164. ABI/Inform & ProQuest Databases, via RIT Library, http://wally.rit.edu (accessed March 31, 2008).

[89] Aileen Ionescu-Somers, Oliver Salzmann, and Ulrich Steger, "The economic foundations of corporate Sustainability," Corporate Governance, Vol. 7, No. 2, (2007): 162-163. ABI/Inform & ProQuest Databases, via RIT Library, http://wally.rit.edu (accessed April 1, 2008).

[90] Sandra Rothenberg, "Environmental managers as institutional entrepreneurs: The influence of institutional and technical pressures on waste management," *Journal of Business Research*, 60, (2007): 751. ABI/Inform & ProQuest Databases, via RIT Library, http://wally.rit.edu (accessed April 1, 2008); in reference to work done by Bardach and Kagan, 1982

[91] Brian Butler, Ecological Balance: The Greater Goal of The Environmental Manager, RIT Master's Thesis, 25 February 2009, page 1.

goals, say to *reduce environmental costs*, *reduce environmental liability* and *reduce regulatory fines and fees,* we can see that:

- An approach to reducing environmental cost might be to reduce the amount of waste that is generated;
- One strategy for reducing environmental liabilities might be to put safeguards in place to avoid unanticipated chemical releases; and
- A way to reduce regulatory fees could be to do more to prevent anticipated releases.

These results might be identified as the actual environmental outcomes of the organization's "environmental goals".

The problem here is one of perception and comprehension. If, for example, an organization's stated "environmental goal" is to *reduce environmental costs*, then instead of reducing the amount of hazardous waste it generates, it may alternatively choose to substitute an equally toxic but less regulated chemical in its production process. If the organization's "environmental goal" is to *reduce environmental liability* rather than to avoid unanticipated chemical releases, it may choose to move some of its more hazardous production activities to facilities in less litigious countries. If an organization's "environmental goal" is to *reduce regulatory fees*, rather than prevent anticipated releases, it may choose to move its regulated activities to countries in which environmental regulations do not exist or are not enforced.

It is essential that organizations have accurate and well-understood environmental goals and targets.

III. The Need for and Challenge of Comprehension

We are almost always more comfortable in our own homes (or countries) than we are in those of others that we may visit. The magnitude of the disparity between these levels of comfort is related to the degree to which we are familiar with the homes we visit. These levels of comfort can be related to our knowledge of the "workings" of these other home, i.e., the rules, procedures, protocols, etc. of everyday living. This knowledge guides our behaviors so that they are appropriate and non-disruptive. Similarly, our level of comfort living on this planet is in part related to our familiarity with its "workings". A knowledge of science is fundamental in this regard. Physics helps us understand how and why a pot of water will boil. Chemistry reveals the properties and interactions of matter. The more we know about how things work, the less likely we are to make mistakes of ignorance. Similarly, ecology reveals the relationships among organisms and in their interactions with the physical environments in which they exist. As an organism that interacts with others and exists within a physical environment, the relevance of ecology for our species should be clear.

If we define environmental sustainability "as meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them" or more specifically "as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity"[92], then we must recognize knowledge of "ecology" as prerequisite to living sustainably, and to effective sustainable business management.

This is quite a tall order and one that ultimately needs to begin being addressed much earlier in one's life than on that individual's first day on the job. While, like other

[92] John Morelli, "Environmental Sustainability: A Definition for Environmental Professionals," *Journal of Environmental Sustainability*: Vol. 1: Iss. 1, Article 2, 2011, available at: http://scholarworks.rit.edu/jes/vol1/iss1/2, page 6.

aspects of professional preparation, there will need to be a related element of lifetime learning, ultimately, ecological knowledge will need to become part of our culture and of the educational legacy that we impart to our children.

Cultural norms and meanings held in common evolve with time owing to a variety of inputs, including but certainly not limited to advances in technology, the presence or absence of adverse conditions and the availability of education.

What we are capable of achieving is thus, in part, a function of what we believe is possible. It was thought impossible to run a mile in four minutes or less until it was achieved in 1954 by Roger Bannister. Now it has become the standard for many runners. As mentioned earlier, it would have been inconceivable in 1970 for an industrial manufacturing facility to achieve zero waste emissions; it simply would have been beyond its possibility horizon. Similarly, we have some doubts today about the likelihood of achieving environmental sustainability. Today however, we have some evidence that progress can be made. In 1964, the Penobscot River in the state of Maine was receiving a pollution loading, in terms of biochemical oxygen demand, of over 1,000,000 pounds per day. Commercial Atlantic salmon fishing in the Penobscot, which once captured over 25,000 salmon per year had dropped to less than 50 by the mid-Twentieth Century. On 22 June 1969 the Cuyahoga River in the state of Ohio caught fire due to an excess of volatile industrial waste discharges. These and other events awakened the nation to the extraordinary extent of pollution in our environment and led to passage of the Federal Water Pollution Control Act and other legislation directed at environmental protection and restoration. Today, the Cuyahoga River no longer burns and, after an absence of four decades, Atlantic salmon have returned to the Penobscot.[93]

[93] "A Water Quality Success Story", USEPA Office of Water Regulations and Standards, December 1980, pp 1,2.

Technological Innovation

A distinguishing characteristic of our species is our use of tools; we are tool users. It is not surprising then that we are as attracted to new technological innovations as moths are attracted to flames, and as with the moths, there is a significant element of potential danger to us associated with this attraction. For example, "the automobile is widely believed to have changed the shape of our cities, shifted home ownership and retail trade patterns, altered sexual customs and loosened family ties."[94] Long-held beliefs, customs and norms can be quickly discarded in the face of new technology and some "primitive" societies have suffered or collapsed when exposed to technologies that were quite common in the west. Now we are living in a time in which the exponential growth of information technology presents an advance of unprecedented proportion.

Not too many years ago, a person seen standing alone on a street corner, yet carrying on an outspoken conversation was likely to be viewed by onlookers as potentially insane. Yet today, with cellular communications, earphones, watch phones, etc. it is quite a common occurrence. In the mid-1980s, the use of email as a communication contrivance seemingly evolved overnight from being a tool for a few and a curiosity for many to a very serious expectation for almost everyone in business. Having a website for one's business grew from an informational opportunity for some to a measure of credibility for all. Additionally, the potential benefit or harm of the current ability of our children to readily remain in electronic contact with everyone they meet is yet to be revealed. The electronic "information age" provides and drives rapid changes in our individual and societal expectations and behaviors. The futuristic vision of being able to converse with a computer in order to retrieve some statistic, or check on the weather, or define an unfamiliar word or concept, or adjust the temperature of one's living room is here.

[94] Alvin Toffler, "Coping with Tomorrow", *Future Shock,* Bantam Books, 1970, Chapter 17.

Information technology can assist in our efforts toward a more environmentally sustainable future. It can provide more ready access to the knowledge of ecology and ecosystems necessary to enable us to see over the symptomatic horizon to better understand the impacts of our activities, products and services. Relatedly, sharing information among environmental professionals in various organizations has been somewhat of a tradition. This has been more likely in the environmental arena than in other areas of an organization's business due to the fact that most environmental management programs are considered to be non-competitive, cost-center operations. Sharing information becomes more complicated on the profit-center side of the equation. Collaboration, rather than competition may be needed for society to move toward a more environmentally sustainable future.

Adversity

Events that cause downturns in the economy and which result in a scarcity of goods tend to stimulate frugality. Individuals who live through extended periods of such stress often retain a sense of thrift and economy well beyond the conclusion of the event. The OAPEC oil embargo against the US and other countries in the early1970s stimulated a variety of energy conservation related responses with lasting, though varying effects.

As dramatic as that period of fuel scarcity was in the US – the long queues for automotive fuel, the endless waiting for fuel stations to be resupplied – the effect on the US economy was buffered by its almost equally dramatic inefficiencies in energy use. These wasteful practices provided ample opportunities for consumers to still meet their basic needs by implementing relatively modest energy conservation measures. Indeed, a comparison of US GDP and oil prices during the 1970s

demonstrates that very significant increases in oil prices resulted in very small decreases in GDP growth.

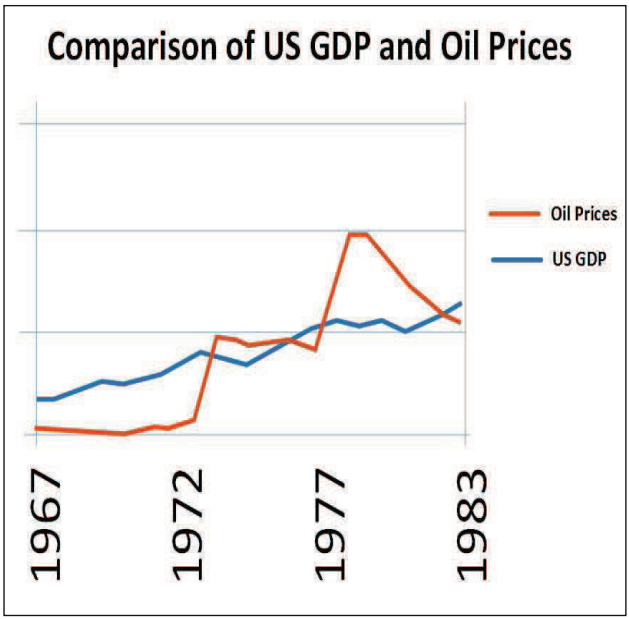

Figure 2 - US GDP & Oil Prices - adapted from Our Finite World: Exploring how oil limits affect the economy.[95]

It was fairly painless at that time for the US consumer to shift from unnecessarily large gas-guzzling automobiles to smaller, more economical vehicles with much higher fuel efficiencies. Unnecessary travel was curtailed, vacation and holiday time was spent at locations closer to home. Alternative energy resources started to become more economically attractive and resources began to be allocated to research and development of related technologies. As global oil prices dropped during the 1980s and most of the 90s, there remained a bit of residual effect from this period of adversity. Though the preferences of many people in the US once again shifted to larger automobiles, it was fewer than before and smaller economical models remained significantly present on US highways. The renewed interest in alternative energy diminished but still remained alive, although related funding support dropped off.

[95] Gail Tverberg, "Exploring how oil limits affect the economy", *Our Finite World*,http://ourfiniteworld.com/2013/02/14/the-connection-of-depressed-wages-to-high-oil-prices-and-limits-to-growth/, accessed 25 September 2015.

While the oil embargo of the 70's was not so much a result of scarcity but rather politically and economically motivated, the reality that finite resources are indeed finite has yet to set into the reality of the western consumer. As mentioned earlier, this is a lesson still not learned.

While money certainly remains the most popular measure by which decisions are made, the inconveniently long times spent waiting in queues at the gas pump exposed the US public for a short while to a better understanding of concept and impacts of resource scarcity. Those who could readily afford to pay the increased price of fuel, were still inconvenienced by the investment of time necessary to accomplish the purchase. Thus their decision to purchase more economical vehicles had more to do with the expenditure of time than of money. A few were perhaps motivated by a longer-term vision of the finiteness of oil reserves will but most saw only the price at the pump and the length of the queues. Most were responding to the symptoms rather than the cause. It may unrealistic to expect for individuals to be concerned about or base decisions upon root causes; perhaps it is also unnecessary at the level of the individual consumer. It is foolish and irresponsible though for leaders of industry to fail to envision and prepare for a longer-term future. Unfortunately, our business leaders do not look toward a distant horizon; their concerns are limited only to the next quarter or next fiscal year, and so what we learn during adverse events is quickly lost in the frantic struggle for near-term profits.

Moving forward there will continue to be threats associated with depletion of finite resources, and at the other end of the economic spectrum, lie threats associated with disposal and waste, perhaps most concerning at the moment being that of global climate change. Continuing to blindly rely on finite resources and ignore the consequences of our waste discharges, flies in the face of sustainability.

These two limiting factors need to be included and considered in our model of the economy. The short-term vision of our industrial leaders and the system that

restricts their vision of the horizon needs to change dramatically if there is to be any help for a sustainable future.

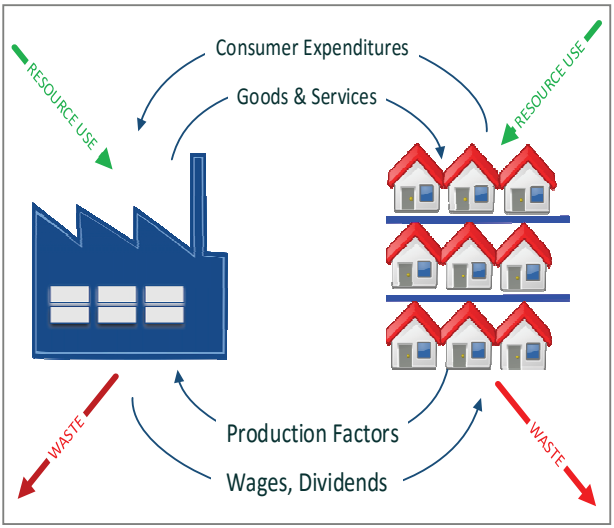

Figure 3 - Revised Model of the Economy

Education

Formal education has been used to establish a commonality among a nation's people and as a means of social control. Education is also acknowledged as an instrument of change in society and culture. In the US, anti-tobacco advertising programs have effectively reduced smoking among teenage children in the US.[96] Internationally, birthrates among women of childbearing age have been shown to be inversely related to the level of education of the women being studied.[97] There is an increasing body of evidence that early childhood education can be dramatically effective in improving learning, social skills and adaptation in later years.

Ultimately, education needs to evolve to integrate an ecological world view.

[96] "Public Education Campaigns Reduce Tobacco Use", Campaign for Tobacco-Free Kids, https://www.tobaccofreekids.org/research/factsheets/pdf/0051.pdf, accessed 22 August 2015.
[97] "Mother's Educational Level Influences Birth Rate", *Birth and Fertility Rates by Educational Attainment: United States*, 1994. Vol. 45 No. 10 supplement, pages 97-1120.

IV. Prerequisites for moving toward environmental sustainability in industry

A Broader Context

Environmental sustainability and social responsibility

As discussed above, it is clear that some of the environmental performance related errors of the past have been as a result of a narrowness of interpretation. The true concept of "sustainability" requires both great depth and great breadth of sight and comprehension. Of all the various reincarnations of environmentalism, "environmental sustainability" is proposed as the highest and most profound level, the one that identifies and addresses causes as well as symptoms, but even at this great height it is still possible to envision a broader and more comprehensive purpose which takes us back to the roots of human behavior and society. We are a social species and as such bear the responsibility to maintain and sustain the society. While some argue that there is inherent value in protecting the environment and preserving other species for their own sake, the reality is that it is quite difficult and perhaps impossible to support that argument without making a connection to its value to our own society. It is thus suggested that "social responsibility" is the higher order of human behavior and that "sustainability" or in this case, "environmental sustainability", is an essential subset of this higher order. Depicted in the pie graph below (Fig. 4) are the seven core subject areas and corresponding issues of social responsibility, as adapted from international standard, ISO 26000.[98, 99] The seven core areas of social responsibility are identified as: environment, health and safety; consumer issues; organizational governance; labor practices; human rights; community involvment and development; and fair operating practices.

[98] *ISO 26000 Guidance on Social Responsibility*, First edition, International Organization for Standardization, 1 November 2010.

[99] The author identifies "Environment, Health and Safety" as a core subject area in place of "Environment" alone, as used in ISO 26000. This is to signify the continuum of related threats (and therefore responsibility) that these three areas of concern represent. Moving from "safety" to "health" to "environment", the corresponding characteristics of responsibility shift from the *individual and the present* to the *larger population and the future*.

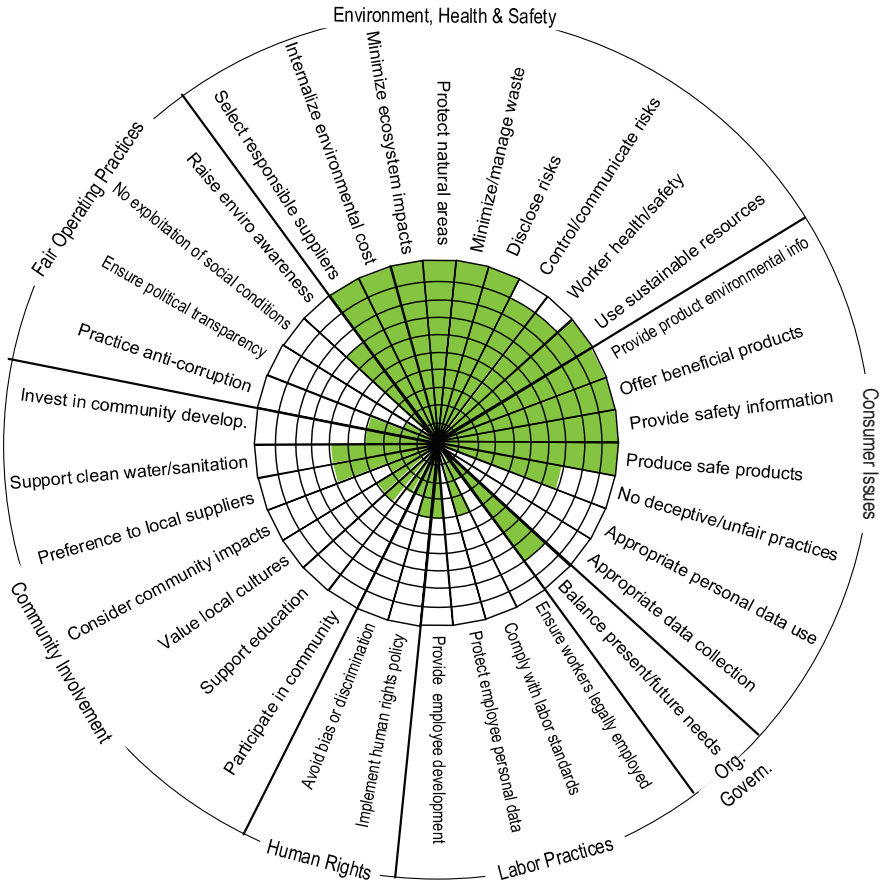

Figure 3 Environmental sustainability elements of social responsibility.

"Slices" of the pie graph highlighted in green are proposed as those most closely aligned with the concept of environmental sustainability. The extent to which each "slice" is highlighted represents the degree to which each corresponding issue relates to environmental sustainability. While the highlighted areas predominate the Environmental, Health and Safety core area, it is clear that this concept extends to varying degrees across all seven core subject areas.

There are increasing expectations that organizations will become more socially responsible and contribute toward improving the health and welfare of society and ensuring healthy eco-systems. More than ever before, social, socio-economic, and environmental influences are being considered in measuring and evaluating an organization's performance. An organization intent on becoming environmentally sustainable will thus need to strategically plot, plan and implement its goals and objective strategies for every core subject area and issue as appropriate for the activities, products and services provided by that organization.

Supporting Principles of Environmental Sustainability[100]

A listing of environmental sustainability principles is presented below. It is not intended to be perfect; it contains some redundancies and certainly does not include all it should. Rather, it is offered as a checklist of the types of consideration needed as part of the decision making process for an organization that truly seeks to move in this direction.

Societal needs

- Produce nothing that will require future generations to maintain vigilance.[101] Many can see and readily understand a model of not disposing of waste outside of one's geographic region (e.g., state or country) so as to hold the generator of that waste responsible for its proper disposal within its regional boundaries. This concept needs also to be applied temporarily so as not to burden generations of the future with the unsolved problems of the present.
- Support fair trade.[102] Exploitive trade practices drive farmers and other producers of goods to engage in practices that have adverse impacts on their supporting

[100] Adapted from: John Morelli, "Environmental Sustainability: A Definition for Environmental Professionals", Journal of Environmental Sustainability, Vol. 1, Issue 1, pages 5, 6.
[101] "McDonough, William and Michael Braungart, "The Next Industrial Revolution, *The Atlantic*, October 1998, http://www.theatlantic.com/magazine/archive/1998/10/the-next-industrial-revolution/304695/, accessed 4 October 2015.
[102]Williams, Sandra. "20 Ways to Go Green." Suite 101, http://www.suite101.com/content/20-way-to-go-green-a33921, accessed 31 Oct 2010.

ecosystems. Fair trade approaches help level the field and foster preservation of such resources.

- Review the environmental attributes of raw materials and make environmental sustainability a key requirement in the selection of ingredients for new products and services.[103] Essentially, a thorough lifecycle assessment should be performed on all of an organization's activities, products and services.

Preservation of biodiversity

- Select raw materials that maintain biodiversity of natural resources.[104] All species, including our own, depend on services of other species for mutual survival. While it is important to continue to expand our knowledge of these interactions, acknowledging and respecting this interdependency is the prudent course of action.

- Use environmentally responsible and sustainable energy sources and invest in improving energy efficiency.[105] Fairly recent technological developments have made such alternatives more available and economically attractive to an organization willing to extend its return-on-investment horizon beyond a few fiscal years.

Regenerative capacity

- Keep harvest rates of renewable resource inputs within regenerative capacities of the natural system that generates them.[106] This, in many cases, will require an organization to focus its attention upstream to its primary resources. Realistically, scope should be limited to the organization's principal and major resource inputs. Collaboration with other users of these resources (e.g., other organizations within the same industry) may be necessary. Alternatively, an organization may choose

[103]"Global Sustainability Principles" 2007, http://www.ecolab.com/CompanyProfile/GlobalSustainabilityPrinciples/Ecolab_GSP_sm.pdf,accessed 30 Oct 2010.
[104] Global Sustainability Principles.
[105] Global Sustainability Principles.
[106] Goodland, Robert. "The Concept of Environmental Sustainability." Annual Review of Ecology and Systematics 26 (1995): 1-24.

to protect its future resource needs by becoming involved in the ownership and management of its primary resource sites.

- Keep depletion rates of nonrenewable resource inputs below the rate at which renewable substitutes are developed.[107] While, at a global scale, this may be an unlikely effort for any single organization, an alternative approach could be to modify its own product or process designs to shift its resource use away from non-renewables.

Reuse and Recycle

- Design for re-usability and recyclability.[108] Using and reusing secondary materials circumvents the linear flow of resources from extraction to disposal. Designing activities, products and services so as to increase the accessibility of such materials will enhance this process.

- Design (or redesign, as appropriate) manufacturing and business processes as closed-loop systems, reducing emissions and waste to zero.[109] Zero waste emissions may not be feasible for all activities. However, organizations may seek out or develop offset strategies to compensate for such activities.

- Keep waste emissions within the assimilative capacity of receiving ecosystems without unacceptable degradation of its future waste absorptive capacity or other important ecological services.[110] Similar but perhaps more complex than an organization's efforts to manage harvest rates for renewable resources, this effort looks downstream to the ultimate fate of the resources it uses.

- Develop transportation criteria that prioritize low-impact transportation modes.[111]

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[107] Goodland.
[108] "Sustainable Living 101 Sustainability Basics", http://www.sustainablelivingdirectory.com/basics.php, accessed 30 Oct 2010.
[109]Robinson, John, "Squaring the Circle? Some Thoughts on the Idea of Sustainable Development", Ecological Economics, 48 (2004): pages 369-384.
[110] Goodland.
[111] Moffat, Andrea. The Ceres Roadmap to Sustainability. No city: Ceres, 2010 PDF file, 45-64.

- Approach all product and services development and management decisions with full consideration of the environmental impacts throughout the life cycle.[112]

Participation

While various principles and practices of sustainability and social responsibility continue to be developed for the organization, there are a few parallel efforts being made to allocate responsibility to individual professions within the organization, or even to identify opportunities for contribution. The vast breadth and depth associated with the concepts of environmental sustainability and social responsibility warrant the need for all functional units within the organization be involved. Each profession through its individual membership and professional associations must thus take stock of its related purpose and define and redefine itself in a process of continual improvement in order to maintain its relevancy and rise to the evolving public demand for a more responsible society and a more sustainable environment.

Since the concept of sustainability is so broad as to transcend any one profession, and not knowing who-should-be-doing-what becomes an obstacle to progress in this direction, research was conducted to help identify to what extent various professions may be prepared and positioned to contribute toward a more sustainable future. In this work, "sustainability" was defined as combining both "social responsibility" as that term is set forth in *ISO26000:2010 Guidance for Social Responsibility*[113] and "environmental sustainability" as defined as:

> *A condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity.*[114]

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[112] Moffat.
[113] *ISO26000:2010 Guidance on Social Responsibility*, International Organization for Standardization, Geneva, Switzerland 2010
[114] John Morelli, "Environmental Sustainability: A Definition for Environmental Professionals," *Journal of Environmental Sustainability*, 1/1 (2011): 19-27.

This project attempted to define the related roles and responsibilities of professionals in various functional units within the organization. Faculty and students at Rochester Institute of Technology conducted this research for a two year period aimed at mapping responsibility for moving an organization towards a more environmentally sustainable and socially responsible future. This involved surveying over 11,000 professionals in the following functional units within the organization:

Environmental, Health and Safety
Legal Affairs
Product & Process Designers/Engineers
Purchasing
Operations/Production
Facility Management
Marketing/Sales
Human Resources
Manufacturing

The premise of the surveys was that the leadership of the organization had announced the company's intention to move the organization toward becoming more environmentally sustainable and socially responsible. Respondents were asked to review a listing of 44 related action items and rate each one with regard to the extent that they as professionals in their respective fields believed themselves to be prepared and positioned to contribute to this effort. They were also asked to identify other professions and/or functional units in the organization who they would expect to participate in each. The survey response rate was 13%. The precision of the survey data, with a 95% confidence level ranged from plus or minus 6.9% to 10.6% for the various department and functional business unit (See Table 1).

Table 1. Statistical Precision for the Professions

Industry	**Precision: +/-**
Manufacturing	6.9%
Environ., Health & Safety	9.5%
Legal	8.8%
Facility Management	10.6%
Human Resources	8.4%
Marketing	10.3%
Operations	6.6%
Product/Process Design	9.6%
Purchasing	9.5%

Table 2, below, presents a portion of the findings of the study describing the potential interest of various functional units in supporting an organization's efforts to become environmentally sustainable and socially responsible. Units indicating a 33% or greater expectation of responsibility were identified as being central to the corresponding action item. An organization possessing such information about its own employees and functional units would be better positioned to distribute and assign related responsibilities and select team leaders for its environmental sustainability action items.

Table 2. Survey Summary

Portion of respondents indicating that they would expect their functional unit to take principal or major responsibility for the specified environmental core area action item.												
		Functional Unit										
Issue	Action Item	Legal	Product & Process Design	Material Mgmt.	Environmental, Health & Safety Management	Purchasing	Manufacturing	Operations	Production	Facility Management	Marketing/Sales	Human Resources
Prevention of Pollution	Measure, record, report and disclose amounts and types of toxic and hazardous materials used and released, and associated risks.	**33%**	15%	17%	***84%***	6%	**33%**	**44%**	**50%**	***80%***	9%	**36%**
Prevention of Pollution	Implement measures to prevent pollution. Minimize and properly manage waste.	**67%**	16%	17%	***86%***	5%	**42%**	**61%**	**63%**	***80%***	9%	**36%**
Sustainable Resource Use	Sustainably manage material, energy and environmental resources. Reduce environmental burden of activities, products and	25%	20%	17%	***70%***	5%	20%	**46%**	**43%**	**60%**	10%	10%
Climate Change Mitigation	Identify potential and manage potential adverse impacts on ecosystems and biodiversity.	**50%**	11%	25%	**64%**	6%	18%	**34%**	25%	**40%**	10%	9%
Climate Change Mitigation	Consider market mechanisms to internalize the cost of organization's environmental burdens.	25%	3%	25%	**48%**	5%	11%	26%	14%	10%	5%	5%
Climate Change Mitigation	Select environmentally and socially responsible suppliers and contractors.	**50%**	3%	25%	**40%**	**60%**	21%	31%	**33%**	10%	6%	5%
Climate Change Mitigation	Incorporate environmental protection into land development projects.	25%	3%	25%	**40%**	5%	6%	16%	14%	10%	3%	5%

Also of interest, were findings comparing the stated expectations of each functional unit regarding its responsibilities for a given action item to the perceptions of others

regarding the responsibilities of that functional unit and action item. Table 3, below illustrates a sampling of these findings. The codes "Y/Y" and "N/N" indicate that there is in fact, a positive correspondence between the self-indicated response of a particular functional unit and the perceptions of others regarding the responsibility of that unit. The codes "Y/N" and "N/Y" indicate non-correspondence.

Table 3 - Self-Indicated responsibility vs perception of others

Correspondence between self-indicated responsibilities of functional units & perceptions of others.								
		Functional Unit						
Issue	Action Item	Legal	Environmental, Health & Safety Management	Purchasing	Operations	Facility Management	Marketing/Sales	Human Resources
Prevention of Pollution	Measure, record, report and disclose amounts and types of toxic and hazardous materials used and released, and associated risks.	Y/N	Y/Y	N/N	Y/Y	Y/N	N/N	Y/N
Prevention of Pollution	Implement measures to prevent pollution. Minimize and properly manage waste.	Y/N	Y/Y	N/N	Y/Y	Y/Y	N/N	Y/Y
Sustainable Resource Use	Sustainably manage material, energy and environmental resources. Reduce environmental burden of activities, products and services.	N/N	Y/Y	N/Y	Y/Y	Y/Y	N/N	N/N
Climate Change Mitigation	Identify potential and manage potential adverse impacts on ecosystems and biodiversity.	Y/N	Y/Y	N/N	Y/Y	Y/Y	N/N	N/N
Climate Change Mitigation	Consider market mechanisms to internalize the cost of organization's environmental burdens.	N/N	Y/N	N/N	N/Y	N/N	N/N	N/N
Climate Change Mitigation	Select environmentally and socially responsible suppliers and contractors.	Y/N	Y/N	Y/Y	N/Y	N/Y	N/N	N/N
Climate Change Mitigation	Incorporate environmental protection into land development projects.	N/N	Y/Y	N/N	N/Y	N/Y	N/N	N/N

Non-corresponding cells are shaded. For example, for the first action item (i.e., "Measure, record, report . . ."), the legal unit has self-indicated that it would expect to hold a significant level of responsibility but the other functional units did not

perceive this to be a potential responsibility of the legal unit. Thus the code "Y/N" (i.e., "Yes/No").

Inconsistencies were fairly frequent, indicating confusion regarding who-does-what, a lack of communication, and/or a lack of coordination. This argues for organization wide strategic planning and design.

Basically, everyone in the organization needs to know how to participate.

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Summary

The sustainability avalanche

The concept of sustainability should regain its original meaning of ecological sustainability or, as Morelli calls it, environmental sustainability – i.e., when the volume of human population and activity remains within the carrying and renewing capacity of the biosphere. The inclusion of society and economy to the concept creates confusion, and, instead of supporting a noble cause, it has negative consequences, because people think that we are heading in a good direction. But we are not. This distortion makes us feel as if everything is all right with the environment. The "three legs approach" is a serious mistake. There is no trade off between environment and economy, environment and society. You cannot say that although the natural environment has further deteriorated but we have good economic results and therefore we have made progress in "sustainability". Similarly, an improvement in the condition of national minorities or wage equalization for women cannot mitigate the increase in pollution.

In the majority of cases sustainability is used in the sense of something being environment friendly but it is ecologically not sustainable and, therefore, is a misnomer. The inflated use of "sustainability" in many other fields, when it is not about the environment, degrades its meaning to nothing more but a synonym for good or something that is wished.

The amalgamation of environmental, social and economic concerns can only be accepted in the case of third world countries where basic economic needs are not met and basic social conditions are not satisfied. But in the case of developed countries this is unacceptable.

The background of the confusion concerning the concept "sustainability" is an economic theoretical one. Sustainability can be correctly interpreted in the context

of ecological economics. (As a matter of fact, ecological economics is based on sustainability and carrying capacity.) “But the endeavours of the neoclassical economics to spread its methodology on a problem - namely sustainability - which originally did not make part of the discipline, results in very contradictory outcomes. These outcomes seem sometimes absurd.”[115]

Recently, great emphasis has been put on the social responsibility and environmental sustainability of firms. Besides the misuse of the concept of sustainability, we do not believe these goals can be achieved voluntarily by a firm acting alone. We think this is the consequence of liberal economic policies. Since the past three decades government intervention to the economy has not been “fashionable” even in Europe. In such cases there is not enough pressure from the top political leadership on the firms to take care of the social sphere and the environment. As a result, corporate responsibility is a second-best solution. What really is needed is a responsible state.

Also, the expression “corporate sustainability” itself is an extreme exaggeration. The most we should speak about is environmental friendly corporate management but by no means sustainable corporations. The usage of the term on corporate level is more of a marketing exercise; it has no scientific background.

Unsustainable world

Sustainability should be interpreted on the global level, but in the absence of a global authority responsible for it, or international agreements on global level we must accept its interpretation on national level (where de facto responsibility is allocated).

Globally, the environmental load in terms of per capita global hectars is 2,70, the biocapacity 1,78 which results a deficit of 0,92. This means that every inhabitant of the world causes a 0,92 global hectar overuse or overshoot in the environment. In other words, we live as we had 1,5 globes. Rich countries live as they had two globes, their ecological deficit is 3,3 global hectars per person. But if everybody lived on

[115]Málovics György. A vállalati fenntarthatóság értelmezéséről.[Interpretation of Corporate Sustainability] JATEPress Szeged 2011,, p. 8.

the level of rich countries, we would need 3,4 globes. Surprisingly, the group of upper-middle income countries (Argentina, Brazil, Russia, except Mexico) does not have a deficit, to the contrary, they have a surplus in the global environmental footprint. This is explained by their very high biocapacity. Although negligible but even the low income countries show up a deficit in ecological footprint (0,11 global hectar per person). The reason is that they are located mostly in arid regions where biocapacity is very low.

Whenever the attributive "sustainable" is used on the industry level (sustainable energy economy, sustainable agriculture, sustainable transport, etc.), it is not correct, it should be "environment friendly". Sustainability is a global concept and the question, whether we remain within the carrying capacity of the ecosystems or not, is a function of whether there appear irreversible processes in the ecosystems or not. (As it is well known, there are a lot of irreversible processes on the global level.) As a result, we cannot measure sustainability on industry level, because on a higher level both the loads and the bio-capacities aggregate and may compensate each other. What does matter is the difference on the global level.

The European Union favours environmental protection by its common environment policy guidelines and directives. Although the EU is a pioneer in environment protection, still, whenever environmental regulation and common market collide, the latter gets the priority.

As a general conclusion we must state that sustainability should be interpreted as ecological sustainability and whenever this attributive is used for industries and firms acting alone, the proper expression should be "environment friendly".

Sustainability through the eyes of the environmental manager

Environmental sustainability will not be easy to achieve; it is complex and not even easy to approach. It represents a significant advance in citizenship, a more thoughtful and thought-out future. It is no small challenge and will require participation of all sectors of society. The private sector must participate along with the larger society

in developing as well as implementing enabling strategies to move us in this direction.

We must recognize that all living things are connected and that we consequently threaten ourselves by degrading our environment, and accept that natural places are necessary for a healthy human spirit, for recharge and rejuvenation. We must understand and accept that the Earth is neither capable of absorbing and recovering from unlimited amounts of contamination, nor providing limitless material, energy and environmental resources.

Society must learn to live within its ecological niche. Economic systems must respect ecological limits and recognize that all ecological facets are connected in ways that are often beyond our comprehension. Environmental sustainability needs to be considered a legitimate and strategic part of doing business. Producers need to be held responsible for the environmental cost associated with their activities, products and services -- in a restorative economy the most competitive producers should be those with the least environmental costs -- our economic systems need to recognize the true cost of doing business.

Environmental regulations need to be accompanied by an understanding of how following them will contribute to protecting the environment. We need to understand that eco-efficiency alone is not a strong enough concept to get us to environmental sustainability; it is insufficient in that it is designed to work within the existing business framework and focuses only on resource use relative to production without addressing absolute measures of impact.

Our focus needs to be broad enough so as not to miss the target while deluding ourselves into believing we are on the right track. It is essential that organizations have accurate and well-understood environmental goals and targets.

We must recognize knowledge of “ecology” as prerequisite to living sustainably, and to effective sustainable business management. More collaboration, rather than

competition, will be necessary for society to move toward a more ecologically sound and environmentally sustainable future.

Our industrial leaders need an economic system that that does not restrict their vision of the horizon to the next fiscal quarter or year.

Organizations need to strategically plot, plan and implement their goals and objective strategies for every environmentally related core subject area and issue as appropriate for the activities, products and services provided by that organization.

All functional units within the organization need to participate.

As mentioned earlier, it would have been inconceivable in 1970 for an industrial manufacturing facility to achieve zero waste emissions; it simply would have been beyond its possibility horizon. Similarly, we have some doubts today about the likelihood of achieving environmental sustainability. Today however, we have some evidence that progress can be made.

It is difficult to say whether environmental sustainability is at all possible today. It is hard to imagine that a single manufacturing company could ensure that not only are its operations conducted and its resources managed in a sustainable manner but also that environmental sustainability is achieved across its entire supply chain, its customer base, and with respect to the ultimate disposition of its products and production wastes. Like in 1970, that vision seems well beyond our possibility horizon. At the level of an entire industry, more leverage to move in this direction might be possible. At the societal level, perhaps even more. However, no one sector holds all the knowledge or abilities.

Envisioning a state that attempts to provide expert guidance and control in every area of commercial production on a scale and within a timeframe that is supportive of industry's need to be competitive, is to envision a massive government requiring a cripplingly large tax burden. However, a state that imposes stringent regulations without such expertise will impose cripplingly high inefficiencies on its industries. In the US, corporations have status as citizens. This gives them extraordinary

influence over the administration of this country and *with such great power must follow great responsibility*.[116] They must contribute. Economically viable environmental sustainability appears unlikely without the participation of the private, public, civic and consumer sectors.

State, market and sustainability

Our study did not deal with the instruments that help us in realizing sustainability; their kinds and numbers are very many and that would have made this paper too extensive. First of all, we wanted to focus on the interpretation of the concept sustainability. Nevertheless, it is important to draft a general idea about its realization. Morelli emphasizes knowledge, information and experience. We must learn from our previous practices, the principles and approaches implemented, the committed errors and insufficiencies. The ecological basis of our knowledge must be widened for everybody, on every level. Kiss agrees with all this but he confesses a kind of "elitist" view in this respect. He does not believe that consumerism will be defeated from below, by the children of consumer society. He does not believe that firm managers will change their practice under the impact of their widening knowledge about the biosphere and its functioning alone. Changes need external forcings and stimuli.[117] The international experience proves that this process is generally initiated by some clever, well informed and "enlightened" high officials. Positive changes take often place first on the international level and when these international fora initiate some idea and measures, progressive governments will follow them.

The two environmental professionals mostly agree in thinking about sustainability. The slight differences between their approaches are reflecting the peculiarities of the American and European economists' ideas about the role of the state and the market

[116] This thought has been attributed to many, from Voltaire to Spiderman.
[117] Although Gandhi said that if you want to change the world, first you have to change yourself.

in the economy. Kiss devotes a major role to state intervention and regulation while Morelli prefers the actions of autonomous units of both the economy and the society. However, these two approaches are not so contradictory, they can be synthesized in a special dimension. If we are thinking of the major characteristics of social-economic management models and philosophies, with "the state knows everything better" on the one side (the archetype of this is the French model) and with "reconciliation of interests involving all stakeholders" on the other (see the English scheme), than the American one is in the middle. According to the American social-economic management philosophy, the state sets the rules and then comes the market which arranges everything and secures efficient solutions.[118] To achieve sustainability, both state intervention and market forces, individual and common efforts are indispensible.

Besides, since institutional economics appeared, the state–market dichotomy has become obsolete. The efficient functioning of the market needs a strong state with developed institutions. Anyhow, market forces should be allowed to operate only to the extent when the biosphere is capable of regenerating and renewing itself. And the demarcation of this limit is the task of the state and the international community.

Managing the global common goods

As elements of the environment are global common goods, their management should take place, first of all, on international level. When using common goods, the phenomena of free riding appears. The best – and at the same time tragic – example for this is managing climate change. (Following Garret Hardin's *The tragedy of commons* we could coin the expression *The tragedy of climate)*. The protagonists on this stage are the USA and China. As since 2005 China is the biggest single CO_2 emitter, and the USA is not willing to undertake obligatory numeric emission

[118] In the field of environmental regulation the most characteristic instruments for the French model are norms, for the English BAT (best available technologies) and voluntary agreements and for the American: permit trade.

decrease, although its per capita emission is far the largest all over the world. China refers to its emerging country status and the so called historical emission records: China's total emission since the industrial revolution is only one third of America. As a result, it is not responsible for the emergence of the problem.

Many oppose the anthropogenic character of climate change. But in this case we should apply the "precautionary principle" because the hazards of an imminent global warming are immensely big. Besides, from the viewpoints of economic rationality and a better life we should apply the same measures as required by climate mitigation even if it did not happen.

The international community fails in another important issue as well: protecting rainforests. The marginal costs of deforestation are very high globally, in terms of increasing climate disorders and loss of biodiversity. According to the Coasian principle the international community should indemnify the countries with rainforests for their losses because of not exploiting the resources of the rainforest regions. But this is not happening.

While we create a "culture of sustainability", inflating and abusing this concept and beguiling ourselves as everything was all right, the doom predicted by the prophet is approaching:

> *For they shall eat, and not have enough: they shall commit whoredom, and shall not increase: because they have left off to take heed to the* LORD. *Therefore shall the land mourn, and every one that dwelleth therein shall languish, with the beasts of the field, and with the fowls of heaven; yea, the fishes of the sea also shall be taken away. Hosea IV/10, 3 (KJV)*