

## ADVANCED SUSTAINABILITY ANALYSIS

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## Summary

In the article sustainable development—as an ethos for improvement of human partnership within the Earth’s life support system—is discussed from general points of view. Sustainable development is presented as the postmodern idea of progress. Secondly a conceptual framework of macroeconomic conditions necessary for advancement of ecological sustainability of the economy and society is formulated. The framework is a set of logical identities, which define relationships between the total environmental stress (TES) and basic indicators of economic, technological and social development. The framework, called the Total Environmental Stress Approach of FFRC, provides logically necessary albeit not sufficient conditions for advancing ecological sustainability.

The explanatory power of the theory is demonstrated with new important concepts derived and empirical results provided. Dematerialization of production, sustainable economic growth, sustainable technological development, gross rebound effect, employment and automation dilemma, structural shift of the economy, immaterialization of consumption, sustainable welfare growth, and welfare productivity of GDP are introduced and analyzed. The applicability of the theory is demonstrated through an empirical case study with Finland’s macroeconomic data.

## 1. The Discourse on Sustainable Development

### 1.1. Roots of the Discourse

The roots of the discourse on sustainable development as an internationally recognized issue extend to the first UN Conference on the Human Environment in Stockholm in 1972 and to some earlier influential studies. The concept “sustainable development” first became prominent in the World Conservation Strategy published by UNDP, UNEP and IUCN (later the World Conservation Union) in 1980.

It was thoroughly discussed and elaborated by the UN World Commission on Environment and Development in 1987 in the so-called Brundtland report, *Our Common Future*. And finally the global ethos of sustainable development was agreed on and confirmed by national governments at the UN World Conference on Environment and Development in Rio de Janeiro in 1992.

Sustainable Development (SD) is generally expressed by the Brundtland Report as an ethos that “humanity has the ability to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” From the discussion it became evident that the meaning of SD is made up of three dimensions: economic, ecological and sociocultural. In the ecological dimension, SD refers to the adaptation of economy and technology to the Earth’s ecological constraints and environmental challenges. In the social dimension SD refers to giving attention in welfare creation to social equity and global solidarity rather than to the shareholders’ profit issue. SD policies should give priority to those who live in poverty, and to achieving better equity both within generations (intragenerational equity) as well as across generations (intergenerational equity).

Provided with unlimited natural resources and with adequate accumulation of appropriate scientific knowledge we were easily able to meet the fundamental human needs of our generation without denying similar opportunities to succeeding generations. However, in a finite world such as ours where the human population is estimated to double while natural capital is depleted and degraded at an increasing pace, we have to challenge the pace of knowledge accumulation. If not in synchrony with each other resources may severely constrain the task of meeting fundamental needs for all either periodically or spatially. Basically, the major options before humans are either a coevolution with nature towards a global sustainable society based on advancing human knowledge and wisdom, or a competitive fragmentation of societies and collapse of life support systems—in the worst case—extinction of humankind. The choice is primarily an ethical and sociocultural one, and only in the second place economic and technological in nature.

As long as the enduring solar radiation maintains adequate exergy flow and entropy exchange for the Earth, sustainable development will be a viable human alternative. The sustainability ethos may be regarded as a late-modern moral intention to keep the Earth living and humankind capable of coevolving with nature. Nature has made us knowledgeable; we have a responsibility to make ourselves wise enough for coevolution with her.

## **1.2. Sustainable Development and Economics**

### **1.2.1. Mainstream Views**

Since the early days from the 1870s to 1970s the mainstream economists (with some notable exceptions) have appeared to believe that continuous economic growth as such could be sustained indefinitely, a claim which would make a special discourse on sustainability superfluous. Mainstream economists continued to argue that continuing economic growth as usual is both feasible and desirable, i.e. a growing economy does not run out of natural resources nor cause excessive environmental harms. Economic growth is considered not only to bring along overall improvement of life and equal opportunity for people, but also it is regarded as necessary in order to finance improvements of the already deteriorated environment. What was called for, however, because of growing environmental awareness, is a more efficiently functioning price system and effective substitution. Such a system would be capable of accommodating

economic activity while still preserving an acceptable level of ambient environmental quality. Economists claimed further that the economic valuation of environmental externalities would make the economy more efficient and accordingly also advance sustainability.

The inherent contradiction of these thoughts is, however, most evident, because the increasing efficiency does not necessarily imply improving intragenerational equity nor equity between present and future generations. On the other hand, economists also thought that resource exhaustion would always be countered sufficiently and in due time by new technology, e.g. by recycling and resource substitution. The technical development was also claimed to increase the quality of labor and capital and allow economic extraction of non-renewable resources to ever lower quality and maintenance of the quality of environment regardless of the increasing amount of wastes, pollution and discharge emissions. There is, however, hardly any knowledge available about the technical development, which would be needed or adequate to meet the challenges claimed. The optimistic view about continuing growth prevailed as the mainstream of economic thinking with the possible “Ricardian scarcity” offset by omnipotent technological development and compensating market processes.

### **1.2.2. Ecocentric Views**

In the 1970s some “revisionists” thinkers targeted to alter the “hard core” of the conventional economic thinking in order to speed up the evolution of economies towards what they regarded relevant to a coming zero-growth society. Some others saw a challenge in trading the environmental constraints necessary for a growth economy with other goals of society. It led to modified economic models but not radically different from the mainstream thinking.

From outside the circle of “hard core” economists, ecocentrically oriented environmental economists threw serious doubts at the acceptability of the conventional growth paradigm, its strategies, and objects. The influential Limits to Growth Report to the Club of Rome adopted the distinctively Malthusian position that the environmental protection policy and the promotion of economic growth objectives were incompatible, i.e. that no conventional economic growth objectives in the long-run—more than 100 years—were feasible. This line of thinking led to calls for a steady state or zero growth economy. The zero-growth argument was buttressed by socioeconomic analyses, which sought to highlight the social and environmental costs of living in a “growth society.” Several lines of reasoning and empirical findings were marshaled to demonstrate that material growth, especially the GDP-measure, was not a proper or sole indicator of well-being and human development, but only one complementary dimension of it.

Several lines of “social limits” thinking may be mentioned here. One is the famous Easterlin’s paradox, which claims that material affluence and human happiness are not correlated. According to another, so called Hirsch’s concept of “positional goods,” the enjoyment of a range of commodities is necessarily restricted to a small group of high income earners, contrary to the claim that all sections of society might one day participate in such a consumption “party.” And further, Scitovsky’s classical concept of “joyless economy” emphasizes the importance of human needs other than plain material

affluence, and Giarini's concepts of patrimony and limits to certainty introduce yet another unconventional frame of reference.

## **2. Ethos of Sustainable Development**

The only dimension left unconquered by controversies in the discourse but commonly agreed on was the cultural one. Increasing cultural competence in the form of ethical awareness, accumulation of scientific knowledge and emerging new technologies has been commonly accepted as a *sine qua non* for sustainable development. Meeting the needs of the present generation is an important part of the ethics and practice of sustainable development. This is not only an economic question, but a question in the social dimension of sustainable development. To the developing countries it seems most important and challenging to fighting poverty and multifaceted deprivations and eradicating them within a reasonable time frame. Increasing poverty and diminishing solidarity among citizens is at present, however, also an acute but not properly prioritized trend running against sustainability ethos in many industrialized countries as well. The eradication of poverty requires e.g. abandoning social institutions maintaining unjust human conditions, and it calls for social development in terms of justice, equal opportunity, and solidarity. Development of just and democratic local as well as global orders is one of the constitutional processes of sustainable development in the social dimension.

The second dimension of sustainability is inevitably an ecological one, and this paper is primarily on meeting necessary conditions of ecological sustainability at the macroeconomic account. Material affluence and poverty both contributes to ecological unsustainability at present. This vicious circle from poverty and affluence to ecological unsustainability must be better understood and, finally, broken through social, economic and technological renewal, effective global economic strategies, and practical civil society actions for sustainable development. Especially the ecological dimension of sustainability is vital to all nations in the same way, because it is really global in nature and approaching it is possible only by joint efforts. The third constitutional dimension of sustainable development is to empower liberal and creative cultural opportunities of people that may generate scientific knowledge, technology, arts and humanistic values intrinsic to sustainable development. Sustainable development as a whole may thus be seen as a dynamic interaction between the three processes mentioned above, i.e. ecological-economic, sociopolitical and cultural-spiritual processes of human reality. The following list presents the summary of the ethos of sustainable development.

- To fight poverty, multifaceted deprivations and unequal economic standing, especially in developing countries.
- To stop the depletion of nature and destruction of the environment, and to accept ecological sustainability as a quality standard in human affairs.
- To secure for future generations the same opportunities for wellbeing and the freedom of choice enjoyed by us.

Sustainable development is an interaction process in three dimensions, which provides a human future that, is socially just and equal, ecologically and economically sustainable, and politically and culturally free and innovative.

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### Biographical Sketches

**Jari Kaivo-oja**, MSc (Econ), Lic.(Reg.Sc.), was born in Finland and graduated from the University of Tampere in Finland in 1990. During 1990–1991 he carried out an international research project concerning energy sector project evaluation (CBA) systems and practices in Tanzania. Between 1991–1994 Kaivo-oja was a project coordinator of a “Demonstration Project for Sustainable Development” in the South-Savo region in Finland. At the University of Tampere in the Department of Regional Studies and Environmental Policy, he also performed a master thesis “TQM System for Environmental Programme Evaluation” (1995). He defended his Lic. Thesis “Essays in Sustainable Social and Regional Development Planning: Futures Approach” in 1998. Since 1996 he has been a staff researcher at the Finland Futures Research Center (FFRC), at Turku School of Economics and Business Administration.

He is the author/co-author of over 110 articles and research reports. His research interests are connected to sustainable information society topics and the use of foresight methods in environmental and socioeconomic policy analysis and management. He has consulted various public and private organizations and made policy analyses for various ministries in Finland. Currently, Kaivo-oja is researcher of Academy of Finland for the socioeconomic part of a large-scale study in the years 1999–2001, in which comprehensive, long-range scenarios are built for Finland according to IPCC model framework. His job at the FINSKEN-project (a part of Finnish Global Change Research Program, FIGARE-program, URL: <http://figare.utu.fi/>) is combining socioeconomic models and climate change models, and building coherent, long-range, and scenario-based evaluation frameworks (IA-frameworks) for country-level environmental and infrastructure policy analysis. He is also a staff researcher at the EU's Terra2000 research program, which evaluates long-run futures scenarios for Europe and world economy, in the years 2001–2003.

**Pentti Malaska** was born in 1934 He married Karin Holstius in 1987; they have two children and four grandchildren. He received a doctor's degree of technology (electrical energy engineering) at Helsinki Technical University in 1966. He was a professor of management science and operations research at the University of Turku School of Economics and Business Administration from 1966 until he retired in 1997, and he founded the Finland Futures Research Center and served as its first director during 1992–1997. He is expert on operations research, corporate strategic and visionary management, and energy policy and energy economics, and he has worked as a consultant for various companies, the State Bank of Finland, and the Finnish parliament. His research subjects cover energy policy, risk and exergy analyses, sustainable development and dematerialization, nature-oriented technology, interaction society and evolutionary dynamics of societal development, Third World problematique, mathematical and computer modeling, and futures studies and its methodology. He is a member of the Finland Academy of Technical Sciences, The Club of Rome, the Finnish Society for Futures Studies (President 1980–1989), the World Futures Studies Federation (Secretary General 1990–1993 and President 1993-1997), and the World Futures Society. He has been awarded the medal of the Finnish Technological Society, the Aurelio Peccei Prize, and medal of the L'Eta` Verde Association; he has also received the Prize of the Finland Society for Futures Studies, diploma and silver medal of N. D. Kondratieff Foundation and Russian Academy of Sciences, medals of the Night and Commander of the Order of the White Rose of Finland. Professor Malaska is an honorary member of the Pakistan Futures Society, the Futures Study Academy of Russia, and Finland Society for Futures Studies. He has authored or edited five books and published over two hundred scientific papers and essays.

**Jyrki Luukkanen** has a Dr. tech. in systems theory and is working as a senior researcher at the University of Tampere, Finland, Department of Regional Studies and Environmental Policy. His main areas of research have been energy and climate policy. He has been developing different modeling approaches to deal with energy use and emissions. His energy and environmental policy studies have covered local, national and international level and main interest in the case studies has been in Finland, Europe and developing countries. He has been a leader of several national and international research projects from the late 1970s. He has held teaching positions as an acting professor of environmental policy and assistant professor of systems theory.