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Designing the Future – A New Scientific Discipline

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ABSTRACT The purpose of this work is to structure our world in such a way that our descendants will have a chance to survive. Firstly, science has access to all human knowledge and must use this knowledge to the best of humanity. And secondly, it has shaped our society up to modern times. The central issue of this article is the implementation pf the University Think-Tank, a world-wide network of the universities for the designing of the future of mankind. The principle Stakeholder Participation implies the participation of all people concerned. The central issue of this article is the implementation of the University Think-Tank, a world-wide network of the universities for the designing the future of mankind. The principle of Stakeholder Participation implies the participation of all people concerned. In my opinion, Designing the Future (the new scientific discipline) is the only that Humanity will survive.

1. THE 'ECOLOGICAL FOOTPRINT'

According to Wackernagel and Rees (1996) the scientific method of the 'ecological footprint' answers the question: 'which level of human activity exceeds the regenerative capacity of the biosphere?' Thus the ecological footprint is a measure of the demands that mankind makes on the goods and services of the biosphere. The demand is measured by comparing the bio-productive land- and water-surface necessary for the satisfaction of human needs, to the Earth's total bio-productive surface – its bio capacity. The ecological footprint concept contains those elements of resource use and waste production for which the planet has regenerative capacities and for which there is data allowing to express this use in terms of bio-productive surface. For instance, the burden of chemical waste and the consequences of global warming are not (yet) incorporated into the concept. Therefore the ecological footprint calculations have a tendency to present a too positive picture.

To calculate footprint and bio capacity, the Earth's bio-productive surface is split in to five categories: agricultural land, pasture, forest, built-up land and a carbon-monoxide absorption surface (Loh et al. 2008). They were calculated by the 'Global Footprint Network'. According to this, each inhabitant of this planet requires on average 2.7 hectares of productive surface, while only 2.1 hectares are available. In other words: ecological resources are globally overtaxed by 30 %. There are huge differences between regions. In the EU countries 4.7 hectares are required, but only 2.1 hectares are available per head. The European bio capacity is thus overtaxed by more than 100%. The inhabitants of the US use 9.4 hectares. Were all the word's inhabitants to claim the same standard, we would require the bio capacity of four planets equivalent to our own!

Back in 1961 the ecological footprint corresponded to roughly half the earth's bio capacity. In the 1980s human annual usage began to exceed the available capacity and has continued to increase ever since. Today, we are short of more than a third of our planet's bio capacity.

Another serious problem of today's social structure is its lack of social compatibility. While the globally widening income gap is an indication, the data of the ecological footprint furnishes the proof (see Fig. 1).

The top-left chart in Figure 1 refers to the world as a whole. The total population, ecological footprint per person and bio capacity per person – always relative to 1961 levels - are shown from 1962 to 2005 (bio capacity per person is defined relative to the globally available surface, measured in global hectares, gha).

While the global population is continuously increasing, the ecological footprint was also rising until around 1970. Since then it has remained constant, in essence because the rich became richer and the poor poorer. Bio-capacity per person is steadily decreasing. This is mainly a consequence of population growth rather than a

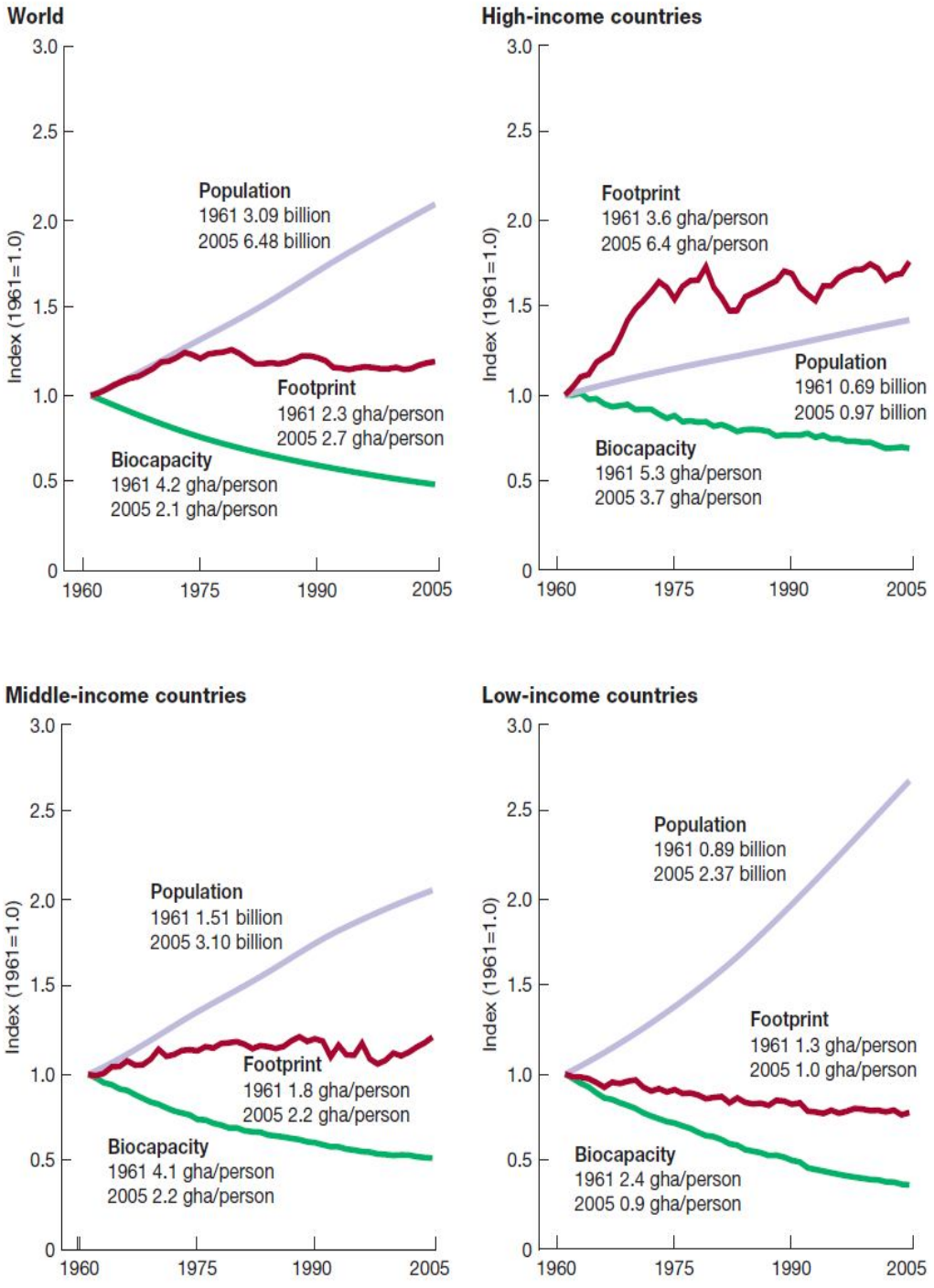

Fig. 1. Ecological footprint, bio capacity and population for the world and for high-income, middle-income and low-income countries, 1961-2005

decrease in the earth's productivity. The remaining three charts in Figure 1 refer to high-, middle- and low-income countries using the same parameters.

The ecological footprint per head, worldwide and within each income bracket is a quantifiable indicator of a population's average wealth. Only the low-income region shows a falling ecological footprint per person while its population is growing the fastest. In contrast, the high-income region sees the highest growth in its footprint and the lowest growth in its population. It follows that today the income gap is wider than ever!

'We are failing due to an erroneous image of humankind. We have to regain our footing in reality'. Van Dana Shiva develops these ideas in an interview in the following statements (her own words):]

- *… to achieve a paradigm change, in order to get away from abstractions, such as the idea of growth or from financial instruments such as derivatives and to regain a footing in reality. This implies encompassing the knowledge of everybody (Women, farmers the country population and of ordinary citizens).*
- *… the realisation of a green economy is only possible if we maintain the balance of the earth. We have to admit that we have already exploited the earth beyond reason, that we have abused it as either a mine or as a rubbish dump. Now is the time to recognise that Gaia (the earth) sustains all life. Our relationship to our planet requires redefinition from an ecological and not parasitical perspective. It is inadmissible that we grow at its expense like a malignant tumour.*
- *in order to evolve from a dead to a living minded form of democracy. Democracy today is no longer made by, for and through the people, but by, for and through corporations. We must not only regain democracy, but also strengthen it.*

What do we learn from the results of the ecological footprint study and the ideas of Van Dana Shiva about the ecological state of our planet? Both, the ecological- and the growth crisis are closely linked to the global economy and its growth. As is demonstrated by numerous examples worldwide, economic growth is an essential driver of environmental pollution and of the social problems of poverty.

Now that the economy is flagging, many states attempt with gigantic economic support measures to rekindle the system. Today we can sense the first indications of renewed economic growth and one is tempted to believe that the economic crisis is behind us. Nevertheless, this approach can't possibly be the solution. Today's economic order, as Binswanger shows in his book 'The Growth Spiral', (Binswanger 2006) is based on the requirement for permanent growth. All measures taken and planned by governments or corporations are merely relieving the symptoms and will lead to more growth, thus accentuating the ecological- and the poverty crisis. Instead we must try to find a sustainable solution to the intertwined growth crises (environmental-, poverty- and economic crisis) as the three problems are closely linked. Therefore the global problem facing society is the 'growth crises'.

It follows that we are facing an epochal change. For the first time in the history of humankind we are overexploiting the bio capacity of our planet and are living at the expense of our children. We are sawing off the branch we are sitting on and not much time is left.

2. SCIENCE HAS A MORAL OBLIGATION

Science has a fascinating history. This history is determined by the cultural context of a region and by outstanding contributions of individuals. Since early modernity universities as centres of learning increasingly determine the evolution of our (western) society. From the second half of the 19th century onwards the emphasis of universities shifted from collecting, ordering and teaching towards research, that is, to the generation of knowledge. Inspired by Humboldt's educational ideal, this unity of research and teaching evolved at the Friedrich-Wilhelm University, today called Humboldt University, and was emulated worldwide. The 1880s universities saw a reordering of faculties. Faculties specialising in sciences, political science, humanities or economics were formed. Furthermore academic seminars gained popularity, where students could exercise their knowledge under guidance. At the same time laboratories, observatories and clinics emerged, allowing the practical training of students.

Contemporaneously with these developments in academia, profound changes occurred

in the economic and social structure of our society – 'the industrial revolution'. This epochal change from an agrarian- to an industrial society can be compared in its significance to the evolution of mankind from hunter-gatherers to settled farmers. Beginning in the late 18th century in England and accelerating in the 19th century, the industrial revolution spread to continental Europe and the USA. In the late 19th century Japan and other parts of Asia followed suit.

The industrial revolution leads to an accelerated development of technologies, productivity and scientific knowledge. Capitalist entrepreneurs faced a salaried proletariat in a new class system. The industrial revolution also marks the beginning of the excessive exploitation of fossil resources. The passage into modernity is marked by 'globalisation'. Hereby we understand the process of the increasingly global integration of all spheres of society (Economics, politics, culture, environment, communication etc.). Globalisation's main pillars are science and technology (the digital revolution, the internet) as well as politics and the economy (trade liberalisation and the reduction of state intervention).

The state of the world reflects these social developments. The result is the growth crisis. Therefore the crucial questions are: Who shapes our future? What would a 'sustainable development' of our society look like?

Many established organisations are attempting to formulate programmes for a sustainable future. For instance:

Club of Rome

The members are economists, industrialists, scientists and other public personalities. The members strive to express their concern and acknowledge their responsibility for the future of mankind. The report of the organisation 'Limits of Growth' (Meadows et al. 1972) was widely noted. Recently, the Club of Rome has presented its new report '2052'. This report confirms dramatic changes for humans and our earth: 'Humanity has exhausted the resources of the earth, and we will witness in a few cases local breakdown before 2052', said Jorgen Randers at the presentation of the results.

Intergovernmental Panel of Climate Change (IPCC)

The IPPC was founded in 1988 by the environmental programme of the United Nations (UNEP) and the environmental organisation for meteorology (VMO). The main tasks of the panel associated to the Climate Convention (UNFCCC) are to scientifically evaluate risks of global warming and to formulate strategies for political decision makers. In 2007 IPCC scientists were awarded, together with Al Gore, the Nobel Peace Price.

Agenda 21

A development and environmental action plan for the 21st century and a framework for sustainable development. At the 1992 Rio de Janeiro 'United Nations Conference for Environment and Development' the Agenda 21 was approved by 172 states. Besides the government representatives also numerous NGOs participated at the conference. One motto of Agenda 21 is 'Think globally, act locally'.

Global Marshall Plan

The 'Global Marshall Plan Initiative' aims to make a contribution towards an ecological and social market economy. The initiative's name refers to ideas developed in Al Gore's 1992 book 'Earth in the Balance' and the historic Marshall plan which after the Second World War stood for hope, solidarity and peace.

More recently, universities created 'Sustainability Science' as a new discipline. It is a new field of applied science, which is concerned with research and the application of sustainable development and sustainability strategies. This is done at a local, regional, national and global level. In 2001 at the 'Challenges of a changing Earth' Congress in Amsterdam, Sustainability Science was officially incorporated by the International Council of Science (ICSU), the International Geo- and Biosphere Programme (IGBP), the International human Dimensions Programme on Global Environmental Change (IHDP) and the World Climate Research Programme (WCRP). Today, numerous universities offer courses in sustainability studies.

Indeed, the ETH in Zurich is involved in an exemplary fashion with teaching and research projects on a sustainable future. Together with the MIT, the University of Tokyo and the Chalmers University of Technology in 1997 the 'Alliance for Global Sustainability' (AGS) was formed, a platform for the cooperation of internationally

renowned technical universities. Research in the field of sustainability is a focus of the ETH Zurich. This is the case within its departments, the different centres of competence, and the various interdisciplinary research institutions. In the broadest sense the field of energy-, climatic- and environmental sciences are the main areas of interest.

Why, in spite of this immense activity, is environmental pollution continuously rising and why is the gap between rich and poor wider than ever before? A solution to the growth crisis is not in view. On the contrary, the World craves renewed economic growth and applauds its first telltale signs as 'successes' after the crisis!

The central problem is the 'political implementation deficit' of the research results on sustainable development. As an illustration we give two examples. 40 years ago the Club of Rome published 'Limits of Growth' (Meadows et al. 1972) on the future of the world economy. Binswanger showed in his book 'die Wachstumsspirale' that today's economy is built on a compulsion to grow (Binswanger 2006). Nevertheless, numerous alternatives for today's financial- and economic structure were developed; for instance 'The Future of Money' (Lietaer 2002) among others.

In spite of all these research results, we have again regressed towards economic growth euphoria and are held ransom by the greed of financial managers and their clients. The political implementation of alternatives has not happened.

A second example for insufficient political implementation concerns the research results of the IPCC on climate change. The international scientific community has irrefutably shown that man-made global warming is occurring and has formulated policy recommendations. However, the 2009 UN summit in Copenhagen, which had the aim to formulate tangible political measures, was a failure.

Nevertheless, there is a series of reasons why the academic community, in collaboration with other groups, must resolve the growth crisis:

- As was discussed earlier, scientific thought stands at the origin of the development of modern society and therefore also shares responsibility for the state of the world today. Universities as institutions and academics as individuals are morally obliged to tackle the issues our society faces today. One of these issues is the growth crisis.
- The scientific community has access to all academic disciplines (natural sciences, social sciences and humanities). It is its duty to make this knowledge accessible to the public.
- Of the various segments of society, such as the political- or corporate world, NGOs and the Churches, it is the academic community, which benefits from the greatest individual freedom and independence. This freedom can and must be used for the public good.
- Especially in times of crisis, the public expects innovative contributions to emerge from the academic world.
- Academic institutions are predominantly publicly funded. This alone underlines their debt towards society.

Two problems remain: First, the political implementation of research results on how a sustainable future should be shaped is not guaranteed. Second, the resulting projects must be realised. For this we need the principle of stakeholder participation.

3. STAKEHOLDER PARTICIPATION: THE UNIVERSITY THINK-TANK

The implementation of the results of the research done on sustainability must be a significant part of the research itself. This is the only way meaningfully to amend the implementation deficit of such research today. The established research structures at our universities do not fulfil this requirement. Therefore, sustainability research requires a new structure. Here other successful development projects can lead the way. Notable examples can be found in the fields of urban planning, landscape development and economic development cooperation (formerly called development aid). Experience shows that such projects tend only to be successful if they are structured according to the stakeholder participation principle. This is a planning principle for development projects, which reflects the needs of the concerned parties and makes them into participants.

This planning principle needs to be integral to sustainability research. As the stakeholders of a sustainable future comprise the world's population, it is essential that sustainability research is structured to reach across academic disciplines. In this context stakeholder participation

happens on two levels. Each academic institution is anchored in its social and cultural context and does sustainability research according to the Agenda 21 slogan: 'think globally – act locally.' This implies that results of sustainability research, which are valid at the global level, can by definition only be implemented locally. After all, politics is also anchored locally. The first level thus corresponds to stakeholder participation in the university environment.

The results must be published in a scientific journal, thereby opening the second level of participation. According to the established and successful pattern of international research, publication acquaints the global scientific community with the research results and these thus enter into peaceful competition with results published by other universities on the same topic. Each single university undertakes its sustainability research with the stakeholder participation of its cultural context. In this way, globally valid solutions can be found which encompass all local social and cultural specificities. This is a form of "global" participation.

As in other disciplines, such as physics or chemistry, the research projects on sustainability are individual projects.

However, the goal of a sustainable global society calls for multiple research projects, for instance, in the search for a new economic order or for measures against CO2 emissions. Step by step the combination of individual results leads towards the solution. This concept has huge, as yet untapped potential and promises a global social order with a sustainable future for humanity.

So far a central question has remained unanswered: How should participative sustainability research be organised within each academic institution? The practical implementation of the concept requires a suitable institution. One such Institution is the 'University Think Tank'. This term comprises the – already existing – global network of universities, as well as the research structure at each university. Let's call the latter 'ideas factory' (Ernst 2003).

As the ideas factories at individual universities are embedded in different cultures, each ideas factory must be organised according to its social context. Furthermore, the hierarchical structure of the institution is to be considered.

Taking the ETH Zurich as an example, we can roughly sketch the outlines of such an ideas factory. In a first step, the executive board ETH should nominate ten scientists in different disciplines (engineers, chemists, meteorologists, social anthropologists, philosophers etc.) as active members of the ETH ideas factory. It is expected from these individuals that, with the aim of collaboration with their colleagues across disciplines, they acquire know-how beyond their specific academic specialisations. An administrative unit supports the ideas factory members. This group has the task of facilitating communication within the ideas factory and with the outside world. While there are many different forms such a dialogue can take, an established and permanent dialogue between the ideas factory and the public is most important. Then the leading members of the ideas factory determine a research topic, for instance the 'New Economic Order'. They discuss the topic with their ETH colleagues and form research groups with ideas factory members or other ETH Zurich members. In a next step, the research group sketches a project plan and invites the participation of those representatives of interested parties who are affected by the research topic. In the above example these would be representatives of the corporate world, economic organisations, politics, of NGOs and religious institutions. The project plan sketch is made available to the different stakeholders.

In a first discussion between the researchers and stakeholders, the foundations of the research project are laid down. It is a precondition for realistic solutions that already during the specification of research questions the practical know-how of current problems is incorporated. The stakeholders let their ideas and suggestions be known, while the researchers get a first hand impression of the social and political realities. Vice-versa the non-university groups get acquainted with new and relevant scientific concepts. The opinions of the stakeholders are documented and are used by the research team for the further development of the project. This discussion process goes through several iterations. The forming of a strategy for the political implementation of research results is an aim, as in all the projects of the ideas factory. Both scientists and stakeholders are equal and complementary partners in this process.

For each research project the selection of stakeholder representatives must be made with care. Generally, the selection should make sure

that the representatives' contribution to the research project constitutes a new and interesting complement to their main professional activity. Nevertheless, the 'hard grind' in the project is carried out by the academics and it is they who are responsible for the project's scientific content. The research results are published in the customary academic format. In an additional report the results are made accessible to a broader public. Before publication, the think tank members must approve the scientific publication and the report. In order to trigger reactions and to dissipate its message broadly, the content of each report is presented to the public professionally (press- and media conference, homepage, event, round-table discussion etc.).

The next phase is the actual political implementation of the think tank's research results. In the example of the new economic order it is again the representatives from politics and the corporate world who assume an important role. Given their understanding of the project, they seem predestined to implement the results – with the active support of the scientific community. The latter leave their ivory tower and enter the political arena, participate in controversial debates, for instance in parliamentary commissions, personally inform economic associations and seek contact with corporations. In this the contacts established during the research project have an important role to play.

4. IMPLEMENTATION

How could the 'University think tank' actually be established as an institution? First, one or several universities set-up their think tanks and carry out active and participative sustainability research. The results are published and politically implemented in the University's local context. Thus the role of universities in politics and, vice versa, of politics in academia is strengthened. Second, other universities, encouraged by successful sustainability research, might be motivated to establish their own think tanks. Gradually a global network of think tanks can emerge following this pattern.

A university think tank should be conceived as a permanent structure, in this way new trends in society can already be incorporated into current research projects. This allows a sustainable and global social structure to be permanently adapted and improved.

5. CONCLUSION

Our planet is facing an emergency and urgently requires help. The scientific community has a moral obligation to help. A sustainable future for all can and must become a reality.

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GLOSSARY

Active Sustainability Research: It denotes sustainable science research projects, where political implementation is built into the project itself.

Bio capacity: It is the ability of the ecosystem to produce biologically useful material and to absorb man-made waste under current conditions. A material is considered biologically useful when it is embedded in economic processes. The comparison of bio capacity and the ecological footprint is a measure of manmade environmental pressure.

Ecological Footprint: The ecological footprint is the necessary terrestrial surface, assuming current production methods, required to maintain one person's lifestyle. This includes surfaces necessary for the production of food and shelter, the satisfaction of energy needs, surfaces which are required for disposal of the generated waste and for the absorption of the carbon dioxide generated by the person's activity.

Growth Crisis: This term is used to mean the triple crisis: The environmental-, poverty- and economic crisis. The term suggests, first, that the three crises are driven by economic growth and, second, that they need to be considered as an interconnected overall problem.

Participative Sustainability Research: It is sustainability research where the stakeholders are involved from the outset of the project.

Sustainability Science: It is a new discipline of applied science investigating sustainability and its application. This encompasses sustainable development strategies at a local, national and global level as well as different practical fields of competence (single enterprise sustainability management, education, etc.).

Sustainable Development: It is development which satisfies the needs of the current generation, without compromising the possibilities of future generations (Brunt land report).

Think-tank: This denotes (in the context of the university think-tank) the institution which is to be created at the individual university.

Trans-disciplinary Research: It is in general, denotes research across disciplines. In the context of the university think-tank, trans-disciplinary research encompasses the following processes: The stakeholders of a research project are invited to participate from the outset of the project. This means participation in the project definition and the realisation of the project. This increases the practical relevance of the project and the subsequent political implementation of the research results. Both scientists involved in the project and other stakeholders actively participate in the political implementation of the research results.

University Think-tank: It is a a new institution, denominates a global network of universities, which is indispensable for the shaping of our future.

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