White paper of the 2012 winter school on limits to growth revisited

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WHITE PAPER OF THE 2012 WINTER SCHOOL ON LIMITS TO GROWTH REVISITED

by the Participants of the Winter School

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INTRODUCTION

The original Limits To Growth (LTG) study published in 1972[1], the "Report for The Club of Rome's Project on the Predicament of Mankind", insistently urged humanity to act. Its vivid and almost haunting description of the consequences of exponential growth which is confronted with finite resources, is still as perspicuous as it was back then: continuous economic and demographical growth will hit the limits of naturally provided resources and very likely lead to overshoot, collapse, and radical decrease of most people's standard of living, accompanied by international crises, conflicts and catastrophes.

This, however, is only one possible future for mankind: Meadows et al. also explored paths to an "orderly end to growth followed by a long period of relatively high human welfare'. LTG made a strong case for the latter, arguing for 'profound, proactive, societal innovation through technological, cultural and institutional change in order to avoid an increase in the ecological footprint of humanity beyond the carrying capacity of planet Earth".[2]

Although the calls for action could not have been coined more urgingly, the LTG study – and lots of studies following after it – failed to bring about actual change towards ways of living that are more appropriate to the natural boundaries of planet earth. Forty years after "Limits to Growth", humanity's ecological footprint has not declined but increased. Today, 1.5 planets are needed to regenerate the renewable resources used

[1] Meadows et al. 1972
[2] Meadows et al. 2004

and to absorb the CO2 emitted at current levels of consumption.[3] Between 1980 and 2008, global resource extraction and use increased by 78%.[4] However, the world has not grown more universally wealthy; rather the gap between the rich and poor has grown.[5]

Paradoxically, all this comes along with much more and deeper knowledge of the processes going on on earth. It is a well-known fact, that for instance 95% of the scientific climate change literature since 1934 has been published after 1951.[6]

Against this background, the Winter School "Limits to Growth Revisited", was designed for a twofold purpose: On the one hand, to recapitulate the state of the scientific debates triggered by the study and to identify desiderata and trends for our own future research. On the other hand, we tried to explore possibilities to transform knowledge to action, and to bring about the change we consider urgent to come about.

The program started with expert presentations on core themes such as demography, modeling and food security. Afterwards, the plenum identified overarching topics to be further developed in six ad-hoc working groups. After two days of discussion, we participated in an international symposium entitled "Already Beyond?" in which several panel discussions with experts took place. After the symposium, we reassembled in the working groups and in our plenum to reflect on the symposium and to identify further fields of research. The outcomes of the different groups shall be presented in the next chapters.

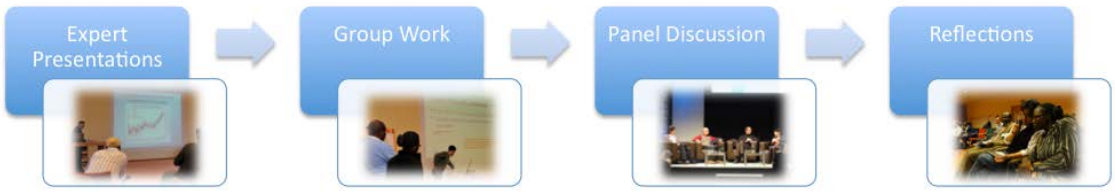


Figure 1: Working modus for working group during winter school

Sustainability and Resilience

Like the researchers in 1972, we are aware that humanity has to reduce the amount of non- renewable resources it needs in order to reach a sustainable state apt to satisfy both basic human needs and the boundaries set by planet earth. Already studies show that anthropogenic climate change of the past 30 years claims over 150,000 lives annually.[7] Such effects are projected to continue during this century and beyond. Millions of people will probably be displaced or die.

Taking this evidence into account, we are aware that it is too late to solely rely on precautionary measures paving the way to utopian equilibrium states. Instead, adaptation to changing environments (esp. in terms

[3] WWF et al. 2012
[4] SERI 2011
[5] People in industrialized countries consume up to 20 times more materials than people in least developed countries (Giljum et al. 2011). FAO (2012) estimates that around 870 million people today are chronically undernourished. Latest statistics from the World Bank (2012) estimate, that 1.29 billion people lived in extreme poverty in 2008.
[6] Le Treut et al. 2007
[7] Sinnott-Armstrong 2005, Patz 2005, IPCC 2007

of climate) is needed. This approach leads to the concept of resilience[8], which we consider as important orientation of both science and politics and that is to complement the already well accepted concept of sustainability.

The relationship between these two concepts, sustainability and resilience, seems not to be clarified yet. Some consider one as part of the other; some see them as distinct concepts. But however this debate will eventually turn out: we consider the duality of them as crucial for the continuation of the work on LTG.

The abstractness and generality of these concepts shall be tried to be dissolve in the following chapters, but it also reflects the nature of the problem we are facing: It arose out of the interplay between economic, social, ecological and climatic processes, and hence is not to be solved by separate disciplines apart, but only in regard of their interconnectedness. This requires interdisciplinarity and cooperation on the part of science as well as systemic approaches on the part of politics and policies.

To assess such kind of systems, computer models have turned out to be the most advanced supporting scientific tool, because they are capable of rigorously capturing disparate knowledge and assumptions in a robust and unambiguous way, with the capacity to be reviewed iteratively and confronted against several possibly conflicting hypothetical solutions.

In order to further improve the quality and applicability of models, a new generation of advanced models is required and recommended for global trends in more depth and at the same time being able to test in-silico the viability of the many possible combined strategies.

CHANGE DIALOGUES

Beyond being an important tool of scientific developments of the future, modeling is also one promising (and already proven) strategy to overcome the obvious barriers between science and politics, or – in other words – the apparent delay in acting against global changes although evidence is continually presented.

Therefore, we consider consequent reflection on the communication and interchange between science and the public as crucial for a modern account of science apt to the problems it is dealing with nowadays and its situation within modern society. The circumstances science has to deal with have changed along the transformation of society itself to what is called, for example, “reflexive modernity” or “information society”. Therein, unpredictable events can suddenly change society‘s focus and with it its research priorities. Researchers must keep all this in mind when planning and implementing their research projects or policy advices.

We see two major points here: Firstly, we accept our position of not being guardian of the truth, but as one societal actor among others. At our Winter School Dennis Meadows mentioned the “doorstep model of implementation” as an approach the LTG research group pursued in 1972. They researched a problem, provided evidence, knowledge, and warnings about the costs of inaction, and laid it on the decision maker’s doorstep, expecting change to happen. Needless to say, the change they advocated for did not happen. The question is, why not? One of the major reasons we think that this kind of communication was ineffective is

[8] The concept of resilience was originally used in material science to describe ‘the power or ability to return to the original form or position after being bent, compressed, or stretched’. Holling (1973) extended this concept into ecology to describe the capacity of ecological systems to deal with changes and disturbances while maintaining fundamental structure and functions. Nowadays, the concept of resilience serves as a property of systems of various kinds, sizes and degrees of complexity.

that it is a “one-way street” approach (telling instead of engaging).

Bearing this in my mind, we call for a humbler attitude for science. Scientists simply do not have all answers and cannot know what others should be doing to bring about change – they often cannot even know for themselves. In order to overcome this mono-perspective view of problems (on all parts), we want to become engaged in “Change Dialogues”, implying that it is not about communicating foregone solutions (even if they are scientifically-sound and evidence-based) but about creating a dialog that aims to engage everyone concerned and targets the co-creation of ideas, knowledge and solutions.

It would be naïve to believe that such change dialogues are easy to set up and bring to success. The higher the scale-level considered, the more difficult it gets, as the number of relevant stakeholders grows, and so does the complexity of the system dealt with. We strongly argue, however, that change dialogs are a better approach to change than any other, as they involve an integration of different perspectives, a more thorough assessment of the status-quo as well as a more careful consideration of consequences. Solutions that emerge from such processes are more robust and more likely to be implemented.

Secondly, we are convinced that in modern societies no aim can be reached only by relying on policies, which are pushed forward in a top-down direction. This means consequently taking into account all the levels of the political and economic system from the individual citizen up to national and international governments. For some fields of research and politics a “dual approach” seems to be a fitting concept, for others – like food and water management – this might be too simple and further differentiation is helpful.

During the symposium Dennis Meadows suggested to distinguish universal from global problems. Thereby universal problems are problems that affect everybody such as air or water pollution but can only be dealt with locally. In contrast global problems such as climate change or ozone depletion can only be solved through global action.

Although this differentiation might be simplistic for some problems, we encourage this subsidiary notion of how to approach problems. But whatever focus or perspective science takes, the reflection of its societal situation also raises ethical questions that have to be thought about, like: How far can science responsibly go in taking influence in public policy making? To what degree must knowledge be certified to serve as basis of action? Are scientific communication and discourse accessible to everyone (in terms of both physical and intellectual accessibility)?

These and further self-reflective questions should be taken into account from the very beginning of every research process in order to gain what the original LTG study failed to achieve: substantial public impact.

After having introduced this overarching framework, the following chapters shall examine these and further criteria to future research in the scope of the most important fields related to this topic, namely Economy, Resources and Energy, Demography, Climate and Food and Water supply.

RESOURCES AND ENERGY

The fact that humanity is going to run out of resources if economic development continues to come along with more intense depletion and consumption poses several questions to the research and development of future energy and resource systems. We consider the two general concepts – sustainability and resilience – to be the guidelines of the next generation of energy production as well as research.

The central questions within this realm appear to be the following: How can an energy system independent of fossil fuels look like? How can it be achieved? How could the transition be designed most efficiently? How could non-renewable resources be produced and consumed more efficiently? What are the basic concepts and methods to measure these transitions and how do they interrelate?

The Sustainability Perspective

In order to transform the energy and resource system towards more sustainability, there are basically three possible fields to take action: (a) The demand side (e.g. per capita caps of non-renewable resource use), (b) The supply side (e.g. industry transition into clean technologies), and (c) The physical side (technological efficiency and resilience improvements).

A possible holistic strategy for resource and energy efficiency based on a combination of these three strategies represent an effective system of measures to achieve the shift towards a sustainable use of existing natural resources and the development of new sources, while improving human well-being equitably and addressing a potential rebound effect.

Having this threefold strategy in mind, energy mix scenarios have been developed considering the massive usage of different forms of renewable energy: bioenergy, geothermal, hydropower, solar, wave and tidal, wind offshore and onshore. Through the increase of renewable, mainly solar and wind power, there is the possibility to increase the final electricity usage up to 120 EJ/year without relying on fossil fuels or on nuclear energy.

A fully renewable global energy system is possible worldwide: a 95% sustainably sourced energy supply can be reached by 2050. The upfront investments required to make this transition in the coming decades (1–2% of global GDP) would turn into a positive cash flow after 2035, leading to a positive annual result of 2% of GDP in 2050. This indicates that this technological transition has always to do with an economical one as well as habits, which shall be examined further in the next chapter.

This points to the next crucial question at hand: will the transition toward renewables be smooth or will humanity need catastrophes or more shocks to shift the course? So what are the measures to take in the global management of mineral resources in order to design the process as smooth as possible? We see the following priorities:

- Sustainable product design from the very first idea unto the production (to extend a product's and its materials' life cycles)
- Efficiency increase in extraction and refining processes.[9]
- Substitution of a product or technology by others that fulfill the same function but create less harmful socio-environmental effects along with product design are key.
- Improvement of material and functional durability (avoiding planned obsolescence), sufficiency, efficiency and consistency.[10]
- Recycling/disposal: using end-of-life products, metals, plastics and other non-compostables as sources of raw materials.

[9] Faultisch et al. 2011, Hagelüken and Meskers 2010
[10] Wäger et al. 2012

The Resilience Perspective

When applying the concept of ecological resilience back to energy systems, it is necessary to understand the difference of human designed energy systems from ecosystems. Like ecological systems, energy systems have characteristics of complexity, uncertainty and unpredictability, but energy systems do not exhibit them to the same degree. Furthermore, unlike the non-intentional evolution and adaptation of ecosystems, the evolution of an energy system is controlled by humans and reflects a purpose.[11] As a result, integrating resilience into energy systems should have different and special characteristics than ecosystems.

We propose the following four characteristics to enhance resilience of energy systems[12]:

- Diversity (multiple energy sources, technologies, and services, alternative sites)
- Efficiency (of costs and ecological harms)
- Cohesion (Wastes recycle and reuse, linkages to other industries)
- Adaptability (Ability to change practices, design, technologies, and resource allocation; learning ability)

In the case of energy system, however, efficiency is often in opposition to the other three characteristics. Even improvements in eco-efficiency, which reduce costs and environmental impacts, rarely result in improved diversity and flexibility.[13] Additionally, improvement of diversity, adaptability and cohesion may increase the complexity and uncertainty, which is generally perceived as a negative in energy systems. These trade-offs have to be considered when designing energy systems for resilience.

One method to specifically measure the efficiency of an economy's energy production is the Energy Return On Energy Invested (EROEI) method[14], which attempts to provide a physically meaningful measure of the chances a given technology has to be sustained in the long run, particularly in a post-carbon era. The EROEI represents the proportion of units of useful energy obtained (Energy Return) using a given technology per unit of energy consumed in the process (Energy Invested).[15]

What we consider interesting about the different approaches presented here is that – though all pointing towards the same direction in principle – they do not necessarily have to go together in all cases. For instance, while the achievement of increased resilience appears as highly relevant for a given option (namely, biofuels), an analysis from the EROEI perspective would suggest that this alternative may not be the most attractive. The problem at hand can be viewed as a complex multi-criteria optimization problem, where optimizing for one criterion alone does not guarantee the convergence to a cross-criteria optimum (in fact, we cannot even assert that such an optimum exists).

Therefore, we conclude that all efforts to drive the necessary shift of the socio-economical metabolism

[11] Seager et al. 2011
[12] After Fiksel 2003
[13] Seager and Korhonen 2008
[14] Cleveland et al. 1984; Hall et al. 1986
[15] A technology with EROEI <= 1 means there is no point in investing in it since we obtain no energy gains, and we are very likely to produce only losses. Any EROEI > 1 is "in principle" useful (though too low values can be not viable). Therefore, among a menu of potential candidate sustainable technologies aimed at replacing fossil fuel-based alternatives, those with higher EROEI deserve more attention and investment. Some argue that the minimum EROEI the world can be run at is above 5 (or perhaps 10) implying less than 20% (or 10%) of the GDP detoured into energy procuring. As an example, the EROEI of domestic oil production shrank from 100 back in 1930 to around 10 in the present (Cleveland 2005). This is what Peak Oil is all about: not the complete exhaustion of oil reserves, but the end of the "cheap" oil era.

towards a sustainable production of energy and use of material must be mapped against a common framework for inter-disciplinary analysis, which can be clearly viewed, criticized and enhanced by all intervening parts. For application, simulation models appear to be the most promising method.

ECONOMIC GROWTH

Unlimited Economic growth is a key driver of resource exploitation and thus ecological crises in the Earth system, as recognized in the original report, the updates to that report, and in other analyses.[16] Even so, forty years after LTG's publication, continuous economic growth remains the accepted paradigm globally in which public policy discourses on economic (and other) matters are contested. As such, conceptualizing (i) socially and ecologically viable alternatives to the economic growth paradigm and (ii) strategies for achieving a shift away from growth to alternative framings of economies that provide a better 'fit' within the living system that is planet Earth are key – and profoundly challenging – sustainability questions. These are complex questions that, of necessity, invite the contributions of citizens, policy makers, researchers and scientists from multiple disciplines.

The extraordinary challenge of conceptualizing alternatives to growth is reflected in the wealth of terminology employed in the contemporary scholarly literature to name alternatives, e.g. green growth[17,] de-growth[18], and post-growth[19]. The fact that these terms have come into being at all highlights the limitations of the growth-dependent sustainable development concept as a societal goal and public policy objective. Quite simply, we need something new. As demonstrated through a host of increased global environmental problems including climate change which in sum constitute global ecological crisis[20], the growth-dependent sustainable development discourse over the past 25 years[21] has been unable to produce overarching policies and radical changes of behavior needed at micro and macro scales.

Our basic concepts of sustainability and resilience should be the future guidelines of economic policies in the place of economic growth as the dominant tool to improve quality of life. Therefore, we propose a departure from the classical economic growth paradigm in order to embrace a 'beyond growth' vision, understood as featuring an equitable and democratic transition to economies and societies built on quality rather than on quantity, on cooperation rather than on competition, and humanity liberated from the limitations of singular pursuit of economic growth at all costs.

For this reason, we consider the following questions as central to be answered by future research: what are the barriers and drivers to moving beyond a growth paradigm? What theoretical and conceptual basis exists or must be developed to allow for growth bounded by physical limits? And may achieving sustainable development requires de-growth in certain material and energy flows?

In order to assess possible strategies to achieve this goal, we developed a framework, taking into account both the economic macro- and the micro-level. The transition towards sustainable (or "post-growth" economy) can be facilitated by macro actors – governments international organizations –with top-down

[16] E.g. Jackson 2009, Latouche 2010
[17] OECD 2011
[18] Latouche 2010
[19] PGI 2013
[20] e.g. Rockström et al. 2009
[21] since Brundtland 1987

actions, as well as micro actors – like organizations, communities, social movements or municipal governments – with bottom-up actions. Macro and micro actors continuously interact, thus reinforcing their individual impact.

Macro Perspective

In the current economic system, policy makers depend in part on GDP growth to solve or suppress social problems. However, humanity witnesses a paradox[22]: economic acceleration is accompanied by the slowdown of development. In other words, while macroeconomic indicators improve, socio-environmental ones deteriorate.

To overcome this paradoxical situation, a beyond growth economy will depend on distributional strategies to address social problems including unemployment, income inequality, health, education and environmental health. Rather than focusing on growth, welfare would be the new buzzword. Essential public services would grow in step with population instead of population and economic growth. Public investments could be relocated, which would mean that renewable energy development and research would not suffer[23].

We envision an economic system which does not sacrifice social and environmental goals in the name of economic growth but that is characterized by equal opportunities for all. Investments in providing each citizen with the means to participate actively in the society will reduce the urge to produce ever-increasing amounts of material wealth will be diminished. As the framework in place is solely focused on economic growth, in order to achieve a different system it is important to have a political, institutional and cultural change.[24]

Potential actions include distributional strategies to address social problems and ensure equal opportunities for all; reallocation of public investments in renewable energy research and production; strengthening of local economies through policies; development of a new accounting system which reflects the ecological contributions to and impacts of economic activity[25] and the support of North-South interaction in the process of finding solutions for a more sustainable economy globally.

The central further questions to research are: How do we measure inequality in the context of climate change? How can technical and social innovation support each other in adapting to a low or no growth society?

Micro Perspective

The question what the role of micro level social movements is in achieving macro level changes has yet to be answered comprehensively. At the business level, however, innovation research[26] has already indicated that bottom-up initiatives may have the potential to effect a large-scale transformation of society through their introduction of more radical sustainability solutions. A policy framework that enables and fosters such micro-level activity sketched out here is one that targets local bottom-up initiatives by, for instance,

[22] Boisier 1997
[23] Kallis 2011
[24] Kallis 2011
[25] Ekins 1993
[26] Cf. Ficher and Clausen 2013

encouraging ownership and enabling access to resources for such initiatives.

Bottom-up initiatives and activities can contribute to increasing independence from growth while at the same time strengthening societies' resilience to change induced by environmental developments such as climate change, resource scarcities and increasing pollution. They can especially deal with "universal problems" by not only acting locally but also using global resources and sharing local solutions with a global audience.

Furthermore, they have the potential to contribute to a new understanding of economic terms such as affluence (by emphasizing other qualities than the material), needs (by focusing on use rather than ownership) and status (by creating a shift from conspicuous consumption to low-impact, high-quality consumption).

The most important research questions we see are the following: What forms of business governance or organizational forms may best support or drive a transition to 'beyond growth' economies? What can we learn from existing organization structures and social movements, like transition towns, social businesses and sharing business models, that may be more compatible with a no or low growth economy? And what can we learn from companies and societies that have experienced limited economic growth but have experienced qualitative growth?

CLIMATE CHANGE

Since the publication of the original LTG report in 1972 much has changed in the public debate and awareness of climate issues and their relation to economic or social developments. In practice, however, there is still a lot to be done.

What are the central problems mankind has to face in the coming years, in science as well as in politics? For the former, the family of resilience, vulnerability and adaptability concepts for example, whose common end is to identify dynamic equilibrium stages and determine measures to prop them[27], opened up a new understanding of stability and even sustainability.

A further necessity is the implementation of systemic approaches to understand the complexity characteristic of earth systems and to disclose their interconnections or 'glocal' insights, to handle specific issues having in mind their implications at larger scales and inversely the often recalled but limitedly implemented inter- and transdisciplinarity, etc. What is clear is that in this dynamic perspectives and interests have to be widened, in science as well as in (geo)politics.

Although the existing climate models are sufficiently informative to justify urgent actions for adaptation and mitigation of climate change, we express the need to produce more robust models on the effects of climate change in order to reduce the persisting uncertainties in climate modeling. To achieve this, emphasis should be put more than ever on multi/inter/transdisciplinarity so as to achieve a multidisciplinary model that will narrow down the uncertainties about the current prediction on the effects of climate change.

[27] Adger 2006, Folke 2006, etc

In the realm of politics, we see three type of strategies how to go about the existing challenges[28]: (1) refinement of current strategies, (2) exploration of new policy options and, (3) adoption of new political strategies.

However, if one takes into account the emergency of a radical modification in our production and consumption patterns in order to reduce our carbon footprint, this will not be enough. A fundamental change in of our life-style is needed that can considerably shrink the amount of carbon dioxide produced by individual activities and hence slowing down climate change. Therefore, Harald Welzer (panelist at the symposium) remarked that it seems worth thinking of future categories and future narratives. For example: How does a culture of resilience look like? How could the quality of interpersonal relationships be measured and fed into a gross national happiness index?

We call for a radical change of paradigm from a top-down to a bottom-up approach in adaptation to climate change. More attention should be given to climate policies and programs at local levels where implementation of national climate change policies must happen. On the other hand, a bottom-up methodology allows to learn from the strategies that grassroots communities have been developing throughout the time to adapt to drought and climate uncertainties. This may help in development of new adaptation approaches that are easily accepted by local people.

Ethical Issues

Aware of the serious harms already evoked and projected to even worsen and the hard questions about responsibility and accountability raised by them, we consider ethical issues to be center of any future climate change discussions, policies and treaties.

A number of things still need to be done. One, a first step to interventions of reducing greenhouse gas emissions and abating climate threats need to understand how people think and keep high greenhouse gas emitting lifestyles. Two, to take responsibility, address fairness and address issues of climate debt and intergenerational equity and develop green virtues. Three, to move towards comparing ecological footprints for each country to see the disparity in the consumptions of Earth's resources in addition to emission levels both within the country and the outsourced services because the highest emitters are outsourcing their industries to the developing world and hence using up a lot of earth's resources than is reported.

In the context of the general crisis of the capitalist system and the ongoing agony of its financial system, we express serious doubts on the capacity of "carbon markets" (or the so-called green business) to deliver significant offsets in the mitigation of climate change. Instead, we call for a rapid and strict regulation of the carbon markets, in order to keep out the racketeers who have found in the green business a way to make profits on the backs of indigenous people in developing countries.

[28] Cf. Compston and Bailey 2008

FOOD AND WATER

In general, one can distinguish two dimensions for any food supply system: on the one hand, the bio-physical system, which determines the amount of food and water which is available for mankind; on the other hand, the social/political system, which determines how the access to these goods is organized. These issues, however, are not only a matter of quantity, but also one of quality.

In the past, these two dimensions have too often been examined separately. The LTG study of 1972 was one attempt to combine those, but its perspective remained global and did not take into account the complex spatial and social heterogeneity within food production and trade systems.

In order to further elaborate the twofold approach and to take into account both the quantity and the quality issue, we want to present two frameworks, which appear to be apt to connect the two perspectives. They should be understood as guidelines of thinking; but they will have to be reconciled with empirical data in every concrete application.

A Political Framework

The global 'food network' is highly fragmented, lacks a central legal authority that is in charge of steering, and is governed by an overabundance of public and private organizations, standards and norms.[29] For this reason, this political framework applies research on the new functional division of labor between the public and the private sector. It argues that – depending on the problem structure at hand and the context-specific resources needed for problem solving in food governance processes – a mixture of public and private sources of authority has, in principle, the regulatory potential to solve global food problems. The "earlier distinction between governments as being public in form and public in purpose, while actors from civil society were regarded as private in form and public in purpose, and business corporations as being private in form and private in purpose, is no longer valid."[30]

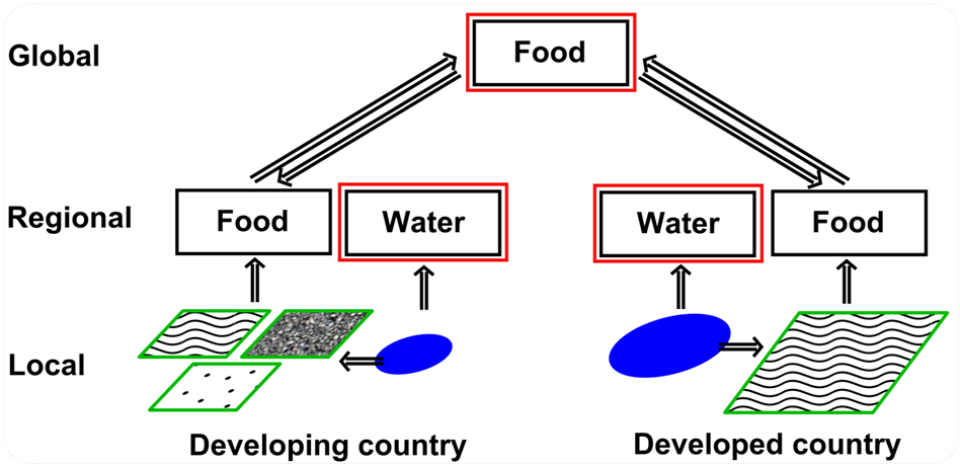
For analysis, one can identify governmental, business and civil society actors as key in food production and distribution processes. In the past years, focus in science as well as politics has shifted from the governmental level to the coaction of those three.

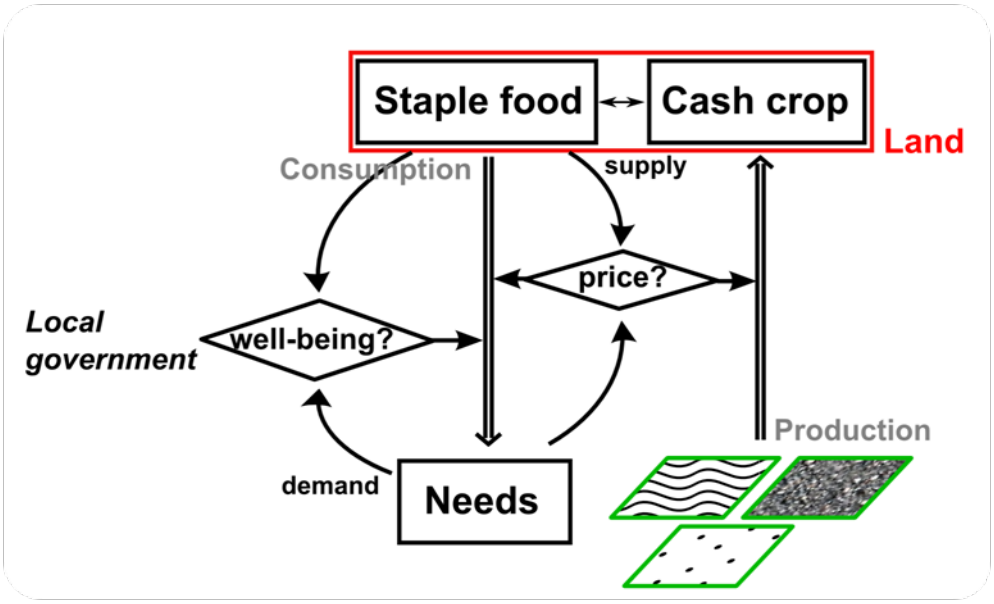
It is clear that all of them bring certain competences, resources and authorities into the process; and a comprehensive approach to problems has to consider all the three of them in correlation. We assume that pooling the different actor-specific sources of political authority is the most appropriate governance approach to solve global food problems.

A Production Framework

In order to combine this rather abstract framework with concrete questions of land use and local, agroeconomical issues, we propose a second framework, which is based on a local perspective and can easily be adapted with spatial explicitness.

[29] Busch 2011, p. 3247
[30] Flohr et al. 2010, p. 4





Here, we identified the main structures (stocks, actors) and processes (flows, regulations) we want to address for the regulation of multi-level water and food distribution. Locally, we compare a household with diversified smallholder agriculture with a distant household practicing industrialized monoculture.

On the regional level, markets are the place for the redistribution of produced food and goods. Here, the most urgent physical boundary is the availability of water. As a consequence, people confined to one region have to agree on the access and usage of water. The question is how much water for each person is a just and secure share? Would they choose to contribute parts of their water for cash-crop production and export?

On the local level, we take a closer looker at the actors involved. It is assumed that a farmer may choose freely to produce a certain amounts of staple food or cash crops. Since arable land is another physical limit, local consumption has to meet the production of staple food if it would be a closed system. This is often not the case because the local market regulates the supply and demand by the price. In the figure, the price is denoted within a diamond which denotes that the price is not automatically given but subject to decisions by participating actors. However, local food prices are also influenced by higher level markets, and even by the local production in other parts of world linked to local prices via the global market (teleconnections).

However, under this type of pricing regime rural people may not afford to buy the required staple food although abundant and quality food is available. The normative aim is that local consumption needs should be fulfilled independently from the price. That is why a local government is needed to monitor the external effects of trans-regional and global trade, to regulate and buffer the access to local food in terms of well-being goals.

Beyond this quantitative aspect of farming and exploitation of ecosystems, the qualitative aspects should not be disregarded. Various case studies have shown the long-term ramifications shrinking biodiversity can have and what big a benefit species-rich ecosystems can be. Taking this into account and considering that the relationship of biodiversity and nutrition was highlighted in the Millennium Ecosystem Assessment[31], we think that agricultural production systems should be focused on the conservation and correct management of biodiversity and ecosystems. It will help to maintain sustainable environments and food security.

Food and Water production from the various perspectives presented in this chapter appears as a multi-faceted field of research, which is closely interconnected with nearly all the other aspects of this paper. So, it is not only to be understood as a key topic of research, but also as interdependent with all the realms of science positioned around it.

DEMOGRAPHY

We argue that the main contemporary demographic challenges are more complex today than they were during the 1970s. Instead of considering only the growth of the total population and its pressures on natural resources, we must face many population-environment interactions. In particular, we have to take into account the population changes that are ongoing in many countries: urbanization, increasing life expectancy, declining support ratios, declining fertility rates, as well as intra- and international migration. In addition, we should think about these interactions in a human rights perspective and consider that we live in a very diverse and unequal world. Our central message is that the main demographic question is no longer how to reach an optimum population, but rather how to promote quality of life in a wide sense, which is not restricted to economic growth. We claim that more sustainable demographic dynamics will follow the improvement in quality of life - statement that is at the same time an evidence-based intuition and a bold bet we hope the world will make.

We present below our most important thoughts about the three components of the demographic dynamics: fertility (defined as the number of children born per woman), mortality (including morbidity and the associated concept of healthy life expectancy), and migration (both within and among countries). Research questions highlight elements for which we need more understanding or data in order to design the policies that identify and enact principles addressing specific issues. These policies should target and include various actors, among which the State is central because it can use regulation to balance the interests of various groups - which is the core of politics. Ethics is imbedded in many dilemmas individuals and societies face regarding demographics.

[31] Wood et al. 2005

Fertility

We consider as a main research question the need to identify the socioeconomic factors that lead to high and low fertility rates, with a special focus on the access to family planning. Policies should address the elderly support ratio in low fertility regions, the availability of resources and social security in high fertility regions, and the need to promote and provide access to family planning everywhere.

The main actors are the individuals (particularly the women), religious groups, and non-governmental organizations committed to gender equality. Politics should give special attention to gender equality and gender preference, among others through the regulations of abortion, adoption, and womb outsourcing. The ethics dimension of fertility proves particularly difficult to tackle as it involves controversial trade-offs among personal values and desires, individual and public goods, and sustainability.

Mortality and Morbidity

The main research question we propose is how to ensure a more equal progress of healthy life expectancy and low premature death rates, both among and within countries? The crucial elements are: (1) the impacts of undernourishment on mortality, healthy life expectancy, and life expectancy; (2) the impacts of climate change on health; and (3) how to better quantify the relationships between causes (e.g. a specific pollutant) and effects (e.g. possible pulmonary disease). Improving basic public health, fostering adaptation to climate change, and preparing to manage disasters, conflicts, and epidemics, especially at the international scale, appear as the most efficient policies. The main actors are pharmaceutical companies, NGOs, medical practitioners, and natural and social scientists. For politics, we stress the need to rethink the questions of ownership of the body, death penalty, and assisted suicide. Three main ethical problems related to mortality and morbidity are the extension of life expectancy, the access to health services, and euthanasia.

Migration

We submit the following research question: under which circumstances does migration lead to temporary win-win-win solutions to environmental, social, or economic problems? By win-win-win, we refer to three elements: the region of origin, the destination region, and the migrants themselves. We emphasize the temporary nature of the pressure release brought by migration, because we believe that massive migrations do not represent long-term solutions to lasting problems.

Typologies and flows of migration, climate change migration, and the absorbing capacity of receiving regions are key themes to consider. Policies have to clearly reflect who the migrants are and where the movements take place, be it through urbanization, seasonal movements of labor force, or migration of highly skilled people, unskilled people, and refugees. The main actors are the migrants of all conditions, the media, and regional and international organizations. Sharing the burden of massive flows of refugees and managing the push-pull factors across countries are difficult political issues. The lack of equal opportunities for all human beings and the discrimination of migrants are ethical problems.

In conclusion, we acknowledge that the Limits to Growth are strongly related to population issues - we think that this relation goes beyond mere population growth. Each population evolves in a specific local context,

not (only) at the global level. Consumption patterns (food, energy, water, goods, etc.) vary strongly, with huge disparities both among countries and between the two sides of the same street.

As population growth rates are declining and developing countries increase their activities, the objective is no longer to plan for population control, but to rethink social inclusion and alleviate poverty without the need for economic growth. In this sense, the global and local balances of well-being and development need a revision. Will the developing countries, in which most of population growth is occurring, continue to accept the current inequalities in level of life? What about the poorer populations in each country, developed or developing? For sure, ever-accelerating quantitative growth and increasing disparities between the "haves" and "have-nots" are the least sustainable options.

CONCLUSION

The different approaches, perspectives, and positions presented in this White Paper exhibit a huge variety of disciplinary backgrounds and viewpoints. Some of them might even contradict each other, within a certain discipline as well as in their interdisciplinary interference. But we are confident that to the same amount there are synergies, positive inferences and cross-disciplinary stimulation to come up if the dialog between the views and approaches exemplified by our Winter School is kept running and hopefully even deepened in future.

This does not at all mean giving up solid and reliable disciplinary bases and claiming the fashionable label of "interdisciplinarity" everywhere and for everything uniformly. Instead, it means continuously opening up our mind and fostering our mutual understanding for each other's methods, points of view, and perspectives.

As this paper indicates, the technical, natural and social sciences are already being brought together by shared concepts (like 'sustainability' or 'resilience') and methods (like modeling). This path should be continued in order to maintain science's capability to solve the problems of mankind's rapidly changing world.

MORE INFORMATION

PICTURES AND AUDIOS:

http://www.volkswagenstiftung.de/en/events/volkswagen-foundation-events/documentation-limits-to-growth.html

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LITERATURE

Boisier, S. (1997): El vuelo de una cometa: una metáfora para una teoría del desarrollo territorial. Revista de estudios regionales 48: 41-80.

Brundtland, G. H. (1987): Report of the World Commission on environment and development: our common future. Oxford: Oxford University Press.

Busch, L. (2011): Food standards. the cacophony of governance. Journal of Experimental Botany 62 (10): 3247–3250.

Cleveland, C. J. et al. (1984): Energy and the U.S. economy: a biophysical perspective. Science 225: 890–897

Cleveland, C.J. 2005. Net energy from oil and gas extraction in the United States, 1954–1997. Energy 30:769–782

Compston, H. and Bailey, I. (Eds.) (2008): Turning Down the Heat: The Politics of Climate Policy in Affluent Democracies. Basingstoke: Palgrave Macmillan.

Ekins, P. (1993). 'Limits to growth'and 'sustainable development': grappling with ecological realities. Ecological Economics 8 (3): 269-288.

FAO (2012). The State of Food Insecurity in the World 2012. Rome: FAO.

Ficher, K. and J. Clausen (2013). Erfolg und Scheitern „grüner" Innovationen – Warum einige Nachhaltigkeitsinnovationen am Markt erfolgreich sind und andere nicht (The success and failure of "green" innovation). Marburg: Metropolis Verlag (forthcoming).

Fiksel J. (2003): Designing resilient, sustainable systems. Environmental Science & Technology 37 (23): 5330-5339

Flohr et al. (2010): The Role of Business in Global Governance. Corporations as Norm-enterpreneurs. Basingstoke: Palgrave Macmillan.

Giljum, S. et al. (2011). European Resource Use and Resource Productivity in a Global Context. In: Ekings, P. and S. Speck (eds.): Environmental Tax Reform (ETR): A Policy for Sustainable Economic Growth. Oxford:Oxford University Press.

Hagelüken, C. and C. E. M. Meskers (2010): Complex life cycles of precious and special metals. In: Graedel, T. and E. van der Voet (eds): Linkages of sustainability. Cambridge, MA: MIT Press.

Hall, C. A. S. et al. (1986): Energy and Resource Quality: The Ecology of the Economic Process. New York: Wiley

Holling, C. S. (1973): Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics 4: 1-23.

IPCC (2007): Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Jackson, T. (2009): Prosperity without growth: Economics for a finite planet. Sterling, VA; London: Earthscan

Johansson, T. B. et al. (2012): Global Energy Assessment. Toward a Sustainable Future, Cambridge:

Cambridge University Press

Kallis, G. (2011): In defence of degrowth. Ecological Economics 70 (5): 873-880.

Latouche, S. (2010): Degrowth. Journal of cleaner production 18 (6): 519-522.

Le Treut, H. et al. (2007): Historical Overview of Climate Change. In: S. Solomon et al. (eds.): Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge and New York: Cambridge University Press

Meadows, D. et al. (1972): The Limits to Growth. A Report for The Club of Rome's Project on the Predicament of Mankind. New York: Universe Books

Meadows, D. et al. (2004): Limits To Growth. The 30-year update. White River Junction, VT: Chelsea Green.

OECD (2011): Towards Green Growth. Paris: Organisation for Economic Cooperation and Development

Patz J. A. et al. (2005). Impact of regional climate change on human health. Nature 438: 310-317

PGI (2013). Post Growth Institute. http://postgrowth.org/. Retrieved on April 2, 2013

Raworth, Kate (2012): A Safe and Just Space for Humanity. Can we live within the Doughnut? http://www.oxfam.org/sites/www.oxfam.org/files/dp-a-safe-and-just-space-for-humanity-130212-en.pdf

Rockström, J. et al. (2009): A safe operating space for humanity. Nature 461 (7263): 472-475.

Seager T. P. and Korhonen J. (2008). Beyond eco-efficiency: A resilience perspective. Business Strategy & Environment 17 (7): 411-419.

Seager, T. et al. (2011): Contrasting risk and resilience approaches to catastrophe management in engineering systems. Risk Analysis, In Review.

SERI (2011). Global Material Flow Database. 2011 Version. www.materialflows.net

Sinnott-Armstrong, W. (2005): Perspectives on Climate Change: Science, Economics, Politics, Ethics Advances. Economics of Environmental Research, Volume 5, 293–315

Wäger, P. et al. (2012): Towards a more sustainable use of scarce metals. A review of intervention options along the metals life cycle. GAIA 21 (4): 300-309.

World Bank (2012). Poverty. Online resources, updated September 2012. http://go.worldbank.org/VL7N3V6F20. Retrieved on September 28, 2009.

Wood, S. et al. (2005): Food. In: Hassan, R. et al. (Eds.): Ecosystems and Human Well-being, Vol. 1, Current State and Trends. Washington, D.C.: Island Press, pp. 209-241.

WWF (World Wildlife Fund) et al. (2012). Living Planet Report 2010. Gland: WWF.