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(FALSE) BELIEFS REGARDING TWO 21ST-CENTURY WORLD CHALLENGES[1]

Frans N. Stokman
ICS, University of Groningen

TWO MAIN 21ST-CENTURY WORLD CHALLENGES

A workgroup of twenty leading scientists and global leaders identified ten global boundaries not to be crossed to prevent serious imbalances in natural systems for the Tallberg Foundation (Tallberg Forum 2008). The group identified 350 parts per million (ppm) $C0_2$ in the air as one of these boundaries. Houghton (2004) shows that we have already reached that level now and that we are heading towards 450 ppm. Politicians consider 450 ppm as the lowest realistic limit for the end of the 21st century. That is the target for the global agreement at the 2009 United Nations Climate Change Conference in Copenhagen, but only a few optimistic people see this as a realistic target and even fear a level of 550 ppm at the end of the century.

The large emissions of $C0_2$ are due to the use of fossil energy. Because of the high gain energy level of gas and oil, these are the two most important resources used at present. The growing world population and the increasing economic welfare of the two Asian countries with the largest populations, China and India, resulted in a tremendous increase in demand for gas and oil. Experts expect that between 2015 and 2025 the demand for gas and oil will be larger than newly proven gas and oil resources, resulting in a decline of overall remaining gas and oil resources. This is known as peak oil (Aleklett and Campbell 2003). As an

extra complicating factor, only two countries are able to satisfy a higher demand for oil and gas than the present one, namely Russia and Iran. Anticipating peak oil to happen soon and realizing the one-sided dependencies on only two countries, politicians and markets shift to coal as a less attractive, lower gain fossil energy resource of which, however, large resources are available for at least two centuries. Presently, mid-2008, China is opening one coal energy power plant a week to fulfil its increasing electricity demand. A shift from gas and oil to coal will increase the problem of CO_2 emissions incredibly, however. The climate killing power of gas is 400 billion tonnes of CO_2, that of oil 600, but that of coal 2000 billion tonnes of CO_2 (Aleklett 2007). Moreover, the one-sided dependencies will hardly decrease as only six countries possess 85% of all known coal resources in the world (USA, China, Russia, India, Australia, and South Africa). And Peak Coal is expected to happen in 2040 already.

To relieve these problems, politicians and markets look for alternative energy resources and technologies to reduce CO_2 emissions. Everybody agrees that in the end we need sustainable energy resources, particularly solar energy in combination with hydrogen. Politicians and markets believe, however, that the development and widespread application of efficient technologies for these sustainable resources require quite some time, at least until the mid of this century. Therefore, many" of them see nuclear energy as a necessary alternative to bridge the time gap between reduced fossil energy resources and widespread availability of sustainable resources. In addition, it is widely believed that more time for the necessary transition can be bought by reduction of fossil energy use through energy savings and the use of sustainable energy resources like biomass, wind and water.

I intend to demonstrate that we can generate new insights in these two important world challenges of the 21st century and widely believed solutions by using Boudon's rich analyses of unintended consequences of social actions and the cognitivist theory of action (CTA). As these world challenges and alternative solutions are connected to policies and policy making, I will place Boudon's CTA within the context of collective decision making processes and show how this exercise both generates new insights and leads to further specifications of Boudon's theory. I will argue how both preferences and cognitive views are connected with each other and how differences in priorities and cognitions can be contributed to a definition of economic growth that has large unintended social

consequences as it strengthens the priority of short-term goals above long-term ones. I will show how a redefinition of economic growth, supported by a certain tax system, will result in a fundamental realignment among stakeholders. It will result in a much better alignment of short-term interests with long-term ones and a more direct solution of the two 21st-century world challenges than the present indirect system, based on emission reductions.

ELEMENTS IN A BOUDONIAN ANALYSIS

All analyses of Boudon start from the fundamental postulate that "any social phenomenon is the effect of individual decisions, actions, attitudes, etc., (individualism)." (Boudon 2003: 3). This postulate is known as the postulate of methodological individualism. Social phenomena result from choices made by many individuals and, as a consequence, may have features that were not included in the explicit objectives of the individual or even of any individual. Boudon gives many examples of unintended, perverse effects and an extensive analysis of perverse effects of educational stratification and mobility policies in his seminal book *The Unintended Consequences of Social Action* (1982). The very notion of perverse effects can only occur in an analytic framework where individuals are moved by objectives they have in mind, by actions with a certain intentionality (Boudon 1982: 7). Perverse effects are effects that the individuals did not explicitly intend:

> ... these effects may be positive, negative, or positive and negative at the same time, for some or for all, and besides this, the actors (all or some of them) may or may not attain their objectives. (Boudon 1982: 8)

Important in Boudon's analysis is that intentionality of individuals is defined in terms of *cognitive representations,* causal mind maps, "a certain distance away from the *classical* notion of rationality", as Boudon states in his book *Theories of Social Change* (1986: 48). A further distance away of the classical notion of rationality can he found in his 2003 article *Beyond Rational Choice Theory* where Boudon formulates explicitly three postulates of his CTA (2003: 10), namely

Methodological Individualism (PI); Understanding (P2: an action can be understood); and Rationality (P3: any action is caused by reasons in the mind of individuals). The further distance away of the classical notion of rationality is due to the fact that Boudon extends the object of the rationality Rationality is connected not only to the classical notion of instrumental rationality (Max Weber's *Zweckrationalität),* but includes also 'evaluative rationality' (Max Weber's *Wertrationalität),* and 'cognitive rationality', rationality concerned with achieving true beliefs: "All these forms of rationality are goal-oriented, but the nature of the goals can be diverse." (Boudon 2003: 10)

As rationality of actions is based on cognitive representations and these representations can be based on false beliefs, an analysis and understanding of rationality should include an analysis of beliefs and whether such beliefs can be taken as true or false, or preferably as to what extent they are false. Such an analysis should also include, according to Boudon, an analysis of the causes of such false beliefs:

> What I am saying is that belief in false ideas can be caused by reasons in the mind of the actors.... In most cases, explanations are more acceptable if we make the assumption that, given the cognitive context in which they move, actors have strong reasons for believing in false ideas. (Boudon 2003: 12)

Boudon applies this approach primarily in the context of scientific theories, where scientists tend to belief in their own theories irrespective of strong theoretical and empirical counterevidence, undermining the objectivity in scientific research. Lindenberg (2006a) rightly argues that strong reasons in this context are related to a much broader phenomenon, well known in cognitive social psychology, namely that we tend to adapt our cognitions under influence of our motivation. If we are very interested in seeing certain results, our cognitions will adapt and, as a consequence, we will see and remember certain things better than others, and, most importantly, we perceive some rules as much more acceptable and more binding than others. I agree with Lindenberg that it is therefore important to connect cognitions to motivations, to goals that individuals aim to reach.

In this paper, the analysis of beliefs is not connected to scientific theories, but to policy options regarding Climate Change and Peak

oil. To understand fundamental differences in policy options between important societal actors, we have to connect differences in cognitive perceptions to goal hierarchies. If such differences are detrimental to the solution of the problems at hand, we have to search for solutions that aim at the modification of goal hierarchies and motivated cognitions in such a way that inhibitors are taken away. The framework of collective decision making, my colleagues and I developed, contains exactly those elements to make such an analysis possible. I, therefore, present first that framework.

BASIC FEATURES OF COLLECTIVE DECISION MAKING

In many situations, people wish to achieve things that can often only be achieved, or can be achieved more efficiently, with the contributions of others. A resulting collaborative effort is referred to as joint production. Joint production requires collective decisions to be taken about how shared interests shall be realized: who should deliver which contributions, and how should the added value of the joint production be divided. But collective decision making itself is also a special case of joint production, because individuals involved in such decisions are mutually dependent on each other in making the required decisions. The joint product in collective decision making is a collective decision that is binding for all actors in the social system. Our approach to collective decision making (Stokman and Van Oosten 1994, Stokman *et al.* 2000, 2009, Thomson *et al.* 2006, Dijkstra *et al.* 2008) has been systematically elaborated from this perspective. It is an example of model building based on the principles of methodological individualism, where the event at the collective level (the collective decision) is linked to the behavioural choices of actors at the micro level. On their turn, the behavioural choices of the actors are linked to their socially constraint interests.

Joint production inevitably involves both *shared* and *conflicting interests* (Stokman and Vieth 2005). Shared interests result from the added value of the joint product; conflicting interests from the division of the added value and the division of the individual contributions to the joint production. The perception of the relative weight of shared interests versus conflicting interests is an important component of *cognitive* dependencies.

Understanding the interdependencies that arise in collective decision making requires a clear distinction between ultimate goals and instrumental goals. Ultimate goals represent the goals that people try to realize in a certain setting. Ultimate goals that are directly or indirectly affected by the joint production specify the outcome interdependencies among the individuals. Shared goals are usually an important subset of them. Instrumental goals can be considered a means through which ultimate goals can be realized (for example introducing an ecotax to improve the environment, see Figure 1). Utility functions for ultimate goals usually increase monotonically (the more economic growth the better) or decrease monotonically (the more pollution the worse) for all actors. Actors, however, differ in the relative weight they attach to different ultimate goals. For example, a multinational corporation will likely give more weight to economic growth than to environmental issues, whereas an environmental pressure group, like Greenpeace, will give the reduction of pollution more weight. Instrumental goals, referred to as *issues* in our approach, typically have an optimum: both too much and too little are undesirable. This is frequently due to the fact that an instrumental goal may be perceived to make a positive contribution to realizing one ultimate goal, but a negative contribution to realizing another ultimate goal. In our example of an ecotax, most actors will rightly or wrongly perceive that a higher ecotax may well reduce not only pollution, but also economic growth. Actors' preferences regarding instrumental goals therefore depend on the weights they assign to different ultimate goals and their perceptions of the relationships between instrumental and ultimate goals. Consequently, different actors are likely to support different optima regarding instrumental goals. Controversial decisions usually concern instrumental goals, although arguments in political discussions are often formulated in terms of reaching ultimate goals.

The outcome on an issue that is optimal for an actor is referred to as that actor's *policy position* (see the upper part of Figure 1). Actors differ from one another not only in terms of their policy positions, but also in terms of their perceptions of the extent to which a decision affects their welfare. If actors believe that a decision on an issue affects their welfare greatly, they have greater interest in that issue. We refer to this as the *salience* of the issue for the actor. The salience of the issue for the actor has two aspects. The first concerns the interest of the actor in a decision outcome close to its own policy position. This first aspect is the actor's

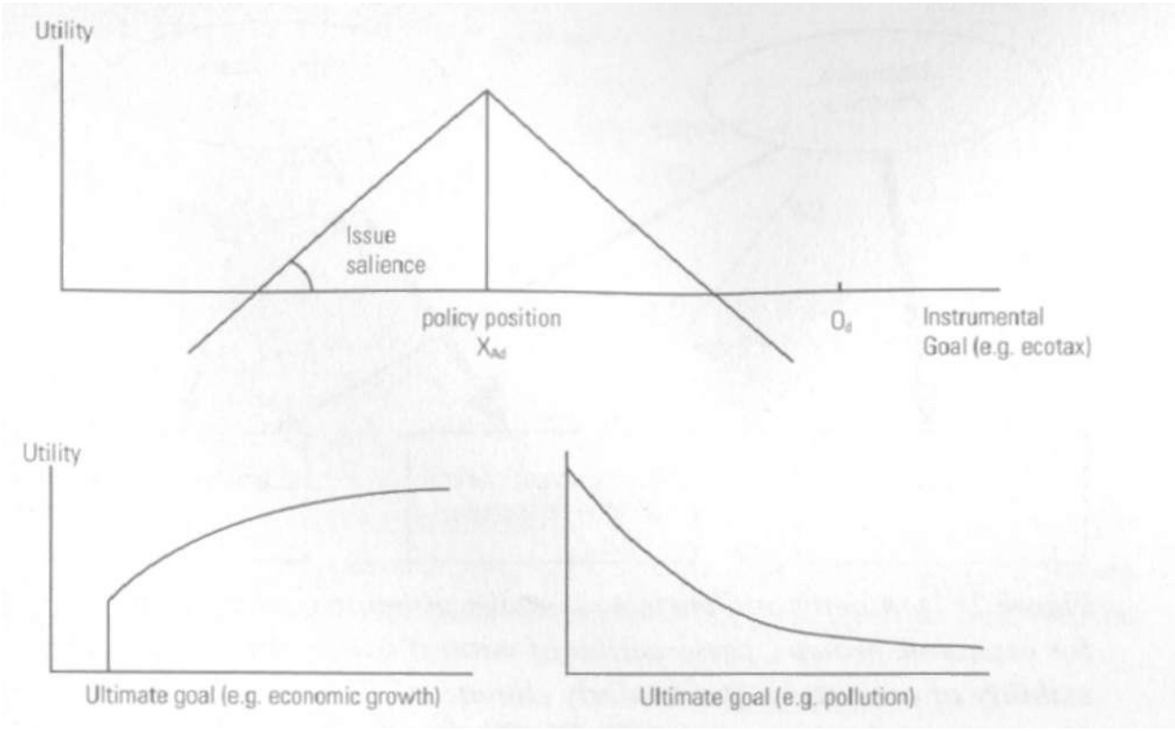

Figure 1: *Utility functions for ultimate and instrumental goals*

issue salience. The issue salience is represented in Figure 1 by the steepness of the utility decline due to the distance between the outcome on an issue and the actor's policy position.[2] The second aspect of salience concerns the extent to which an actor has an important stake in arriving at a common position with other actors. A special case of this aspect of salience concerns the desire to arrive at a unanimous outcome that is accepted by all actors involved. Particularly within organizations, decision making by unanimity is often a strong informal norm, influencing the extent to which actors are willing to compromise. This second aspect of salience is referred to as the actor's *group consensus salience*. The ratio of the group consensus salience to the issue salience defines the extent to which the actor will compromise to arrive at a joint decision.

This analysis of collective decision making implies that different policy positions and saliences on issues between actors are, apart from possible strategic motivations, mainly due to two elements: to different weightings or priorities of ultimate goals between actors and to different perceptions of relations between instrumental goals and ultimate goals (in other words to different cognitive maps). This framework provides

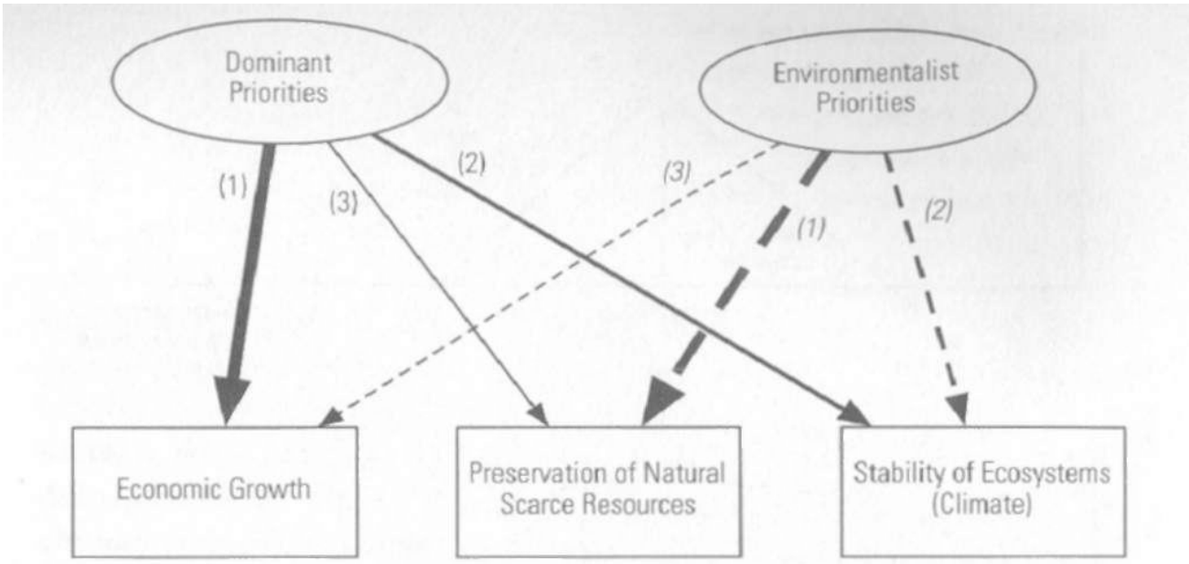

Figure *2: Dominant and environmentalist ultimate goal priorities for economic growth, preservation of natural scarce resources, and stability of ecosystems (particularly climate)*

The numbers in brackets and thickness of the arrows indicate the order of priority given to an ultimate goal.

us with a simple tool for the investigation of cognitions and how these are connected with fundamental interests of actors and the related differences in priorities for ultimate goals. Such an analysis will reveal the motivational and cognitive reasons behind conflicting interests and ways to transform them in such a way that they disappear or cease to block the realization of shared interests. I will now use this tool for an analysis of (false) beliefs regarding the two main world challenges of the 21st century: climate change and peak oil.

I consider three ultimate goals: economic growth, preservation of natural scarce resources, and stability of ecosystems (particularly climate). Figure 2 shows the priority orders for two types of actors, the dominant group, consisting of most Western governments and large corporations, and the group of environmentalists, supported by an increasingly large group of scientists. From highest to lowest, the rankings are:

For the dominant group:

1. Economic growth,
2. Stability of ecosystems,
3. Preservation of scarce natural resources

For the group of environmentalists:

1. Preservation of scarce natural resources,
2. Stability of ecosystems,
3. Economic growth

I emphasize again, that both groups are assumed to see positive utilities in higher values on each of the three goals, but differ only in their priorities concerning which of the goals has to be promoted first, and in case of conflicts between the three goals, which of the goals gets priority above the other.

I consider two instrumental goals or issues: tax exemptions for sustainable resources and measures for reduction of polluting emissions. Figure 3 shows only differences in perceived relationships between the

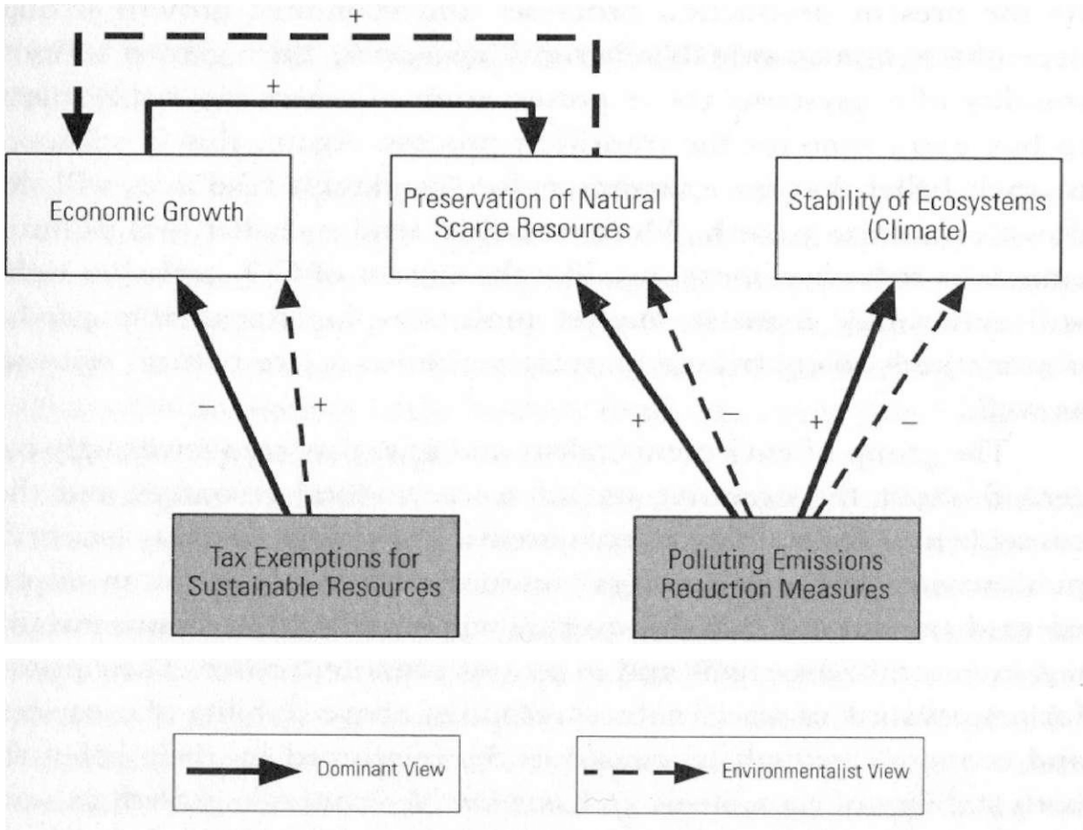

Figure 3: *Differences in cognitive perceptions of relationships between issues and ultimate goals (similar relationships not shown). The sign of the arrows indicates whether we are dealing with a positive or negative relationship*

two groups; similarly perceived relationships between the two groups are not represented to keep Figure 3 simple.

I base these differences in priorities and cognitive maps on the following reasoning. The interests of the dominant group are strongly related to short-term successes. Shareholder value has by far and increasingly the highest priority of large corporations and they successfully enforce this priority by shareholder value related bonus systems for their highest officers. Economic growth is also for politicians an almost necessary condition to be re-elected, in other words a necessary condition to survive as ruling politicians. The priority of economic growth above preservation of scarce natural resources and stability of ecosystems is further reinforced by their belief that economic growth is a necessary condition to have sufficient financial resources for the large investments for a transition towards a sustainable future with preservation of scarce natural resources and stability of ecosystems. As the present production processes and economic growth strongly depend on non-sustainable natural resources, they give priority to stability of ecosystems above preservation of scarce natural resources to buy extra time for the transition process. Again, this is reinforced by their belief that tax exemptions for sustainable resources will slow down economic growth. Moreover, they tend to belief that polluting emissions reduction measures, like the system of CO_2 emission rights, will sufficiently increase market incentives for sustainable production methods to contribute to preservation of scarce natural resources as well.

The group of environmentalists and scientists are increasingly concerned about the excessive use of scarce natural resources and their consequences for stability of ecosystems. They stress in many (scientific) publications that scarce natural resources are overused in an unprecedented amount and that this overuse will result both in serious instabilities in natural ecosystems and in serious economic crises. Their priority for preservation of scarce natural resources above stability of ecosystems and economic growth is, consequently, reinforced by their belief that both stability of ecosystems and *sustainable* economic growth can only be achieved by the use of sustainable resources. They therefore perceive a positive relationship between tax exemptions for the use of sustainable resources and economic growth. At least some of them, moreover, perceive a negative relationship between polluting emissions reduction

measures and preservation of scarce natural resources and stability of ecosystems as these measures tend to be used to buy more time for the overuse of non-sustainable resources, particularly fossil energy resources. This is particularly true for the intended storage of CO_2 in empty gas and oil fields to reduce CO_2 emissions without reduction of the use of fossil energy resources.

We conclude that differences in policy positions between the two types of actors can be seen to depend not only on their differences in priorities for the ultimate goals but also on differences in their cognitive maps of the relationships between issues and ultimate goals. The latter seem to reinforce the differences in priority. The reinforcement between priorities and cognitive maps is due to differences in relative importance of short-term versus long-term goals between the two groups. I will elaborate on this in the next Section.

MYOPIA: THE RELATIVE DOMINANCE OF SHORT-TERM GOALS ABOVE LONG-TERM ONES

When food cannot be preserved for a long time, enough food for the next days or the next season is of higher importance than anything else. As this was the case for the whole long pre-agriculture period, myopia, the prevalence of short-term goals above long-term ones is deeply rooted in our genes. In his analysis of different goal frames, Lindenberg (2006b) attributes the dominance of the hedonic frame above the gain frame and the normative frame to myopia.

In complex societies, there are certainly a number of institutions to correct myopia. A nice example in our present society is obligatory retirement arrangements by which political authorities enforce citizens to save money for their old age. Obligatory social security systems for unemployment and illness are other examples. There are, however, other institutions that reinforce myopia. Earlier, I mentioned that shareholder value related bonus systems tend to reinforce myopia, as the short-term shareholder value determines the value of the bonuses. In politics, the periodic general election of political authorities tends to increase the prevalence of short-term goals as short-term successes strongly determine the likelihood of re-election. The large attention of mass media for bad news above good news, for political failures and scandals, tend to make

politicians not only myopic in the election year, but also in the years in between two elections.

The present unprecedented overuse of scarce natural resources, particularly fossil energy resources, is an example of myopia. Historic research has shown that we are not the first complex society that overuses its high gain energy resource. In his overview of historic research of declines of complex societies, Tainter (1996) attributes the declines of complex societies to the fact that these societies tend to use their high gain energy resources without anticipation for future generations. As a result, the costs of exploitation of high gain energy resources tended to increase to such levels that the marginal costs of exploitation surpassed the marginal utility of the increased complexity of society, necessary for exploitation and political control. As just one example, agriculture was the high gain energy resource for the Roman Empire, comparable to fossil energy resources for our society. Due to exhaustion of land, food had to be produced from less and less fruitful land. At first, more land could be gained by cutting down forests, but at a certain moment food had to be transported over longer and longer distances, resulting not only in higher transportation costs, but also in higher costs of political control. As a result, the Western part of the Roman Empire imploded, whereas the Eastern part was taken over by surrounding complex societies.

The present overuse of our high gain energy resources without anticipation for future generations is consequently not unique, but deeply rooted in our genes and institutions that increase the importance of short-term goals rather than correct that preoccupation. Due to our advanced technology, size of the world population, and spread of our welfare over larger parts of the world, the amount of overuse is unprecedented and the consequences for future generations unprecedentedly disastrous, unless we make a quick transition towards sustainable resources. Strangely enough, and this is different from earlier examples of overuse in complex societies, we have new technologies available, but we do not apply them or not sufficiently enough to make a real impact. I will argue that this is at least partly or even mainly due to the misleading, short-term promoting definition of economic growth. I will elaborate on that in the next Section.

THE FALSE BELIEFS INDUCED BY THE MISLEADING DEFINITION OF ECONOMIC GROWTH

The differences between the dominant and the environmentalist priorities and cognitions are primarily related to economic growth. In the arguments behind the dominant priorities and view, economic growth is typically a short-term goal: the economic growth of the present year or the past and next years. In the arguments behind the environmentalist priorities and view, economic growth is defined more in the direction of sustainable economic growth over at least a somewhat longer period. Economic growth can therefore be seen to represent short-term goals, whereas preservation of scarce natural resources and stability of ecosystems represent long-term goals. The short-term goal of economic growth is not necessarily in line with the two long-term goals, as we all know. Economic growth represents the increase in our welfare. Yet, how is it possible that we can become richer in the short run, while becoming poorer in the long run? Isn't this a *contradictio in terminis?* If so, the definition of economic growth is incorrect and this causes, as yardstick of economic policies, the prioritizing of short-term goals without bringing them in line with long-term ones. And that is exactly the case.

With the exception of tentative alternative computations by the World Bank,[3] all important financial institutions, economic planning bureaus and governmental policies define economic growth purely in monetary terms. It disregards three elements, the neglect of which results in the strange phenomenon that we can become richer in the short run while becoming poorer in the long run. This implies that economic growth as presently measured is not necessarily sustainable. The most widely used definition of sustainability is that of the Gro Harlem Bruntland Commission, that defined sustainable development in 1987 as "development that meets the needs of the present without compromising the ability of the future to meet their own needs" (Tainter 2006). In other words, sustainability implies that we "leave future generations as many opportunities as we have" (Serageldin 1996: 11). As Seregaldin illustrates, we presently have a measure of economic growth in which a forest does not contribute to economic growth as long as it is not cut, but adds to economic growth when it is cut. Whereas forest can be replaced within decades, oil, gas, and coal not. We consequently have to subtract asset sales from economic growth if we want to align short-term with

long-term economic growth. Seregaldin includes in his analysis four types of assets: man-made (the only one included in financial and economic accounts), natural capital, human capital, and social capital. In addition, net foreign borrowing and depreciations have to be abstracted from the traditional measure of economic growth in order to obtain an approximation of sustainable economic growth. Since the early Nineties of the past century, the World Bank computes such an index, for illustrative purposes, based on rough estimates of these assets. As an illustration, Figure 4 applies such an adapted measure of economic growth for Latin America over the period 1967-1991 (Serageldin 1996: 13). It shows how fundamentally different our judgment of economic growth is for Latin America over that period. Whereas the traditional measure of economic growth shows similar values for the beginning of the 1970s and 1980s, the sustainable economic growth was still positive in the beginning of the 1970s but negative for the beginning of the 1980s.

Two conclusions come into mind. The first one is that the champions of the traditional rational choice theory produced a measure of

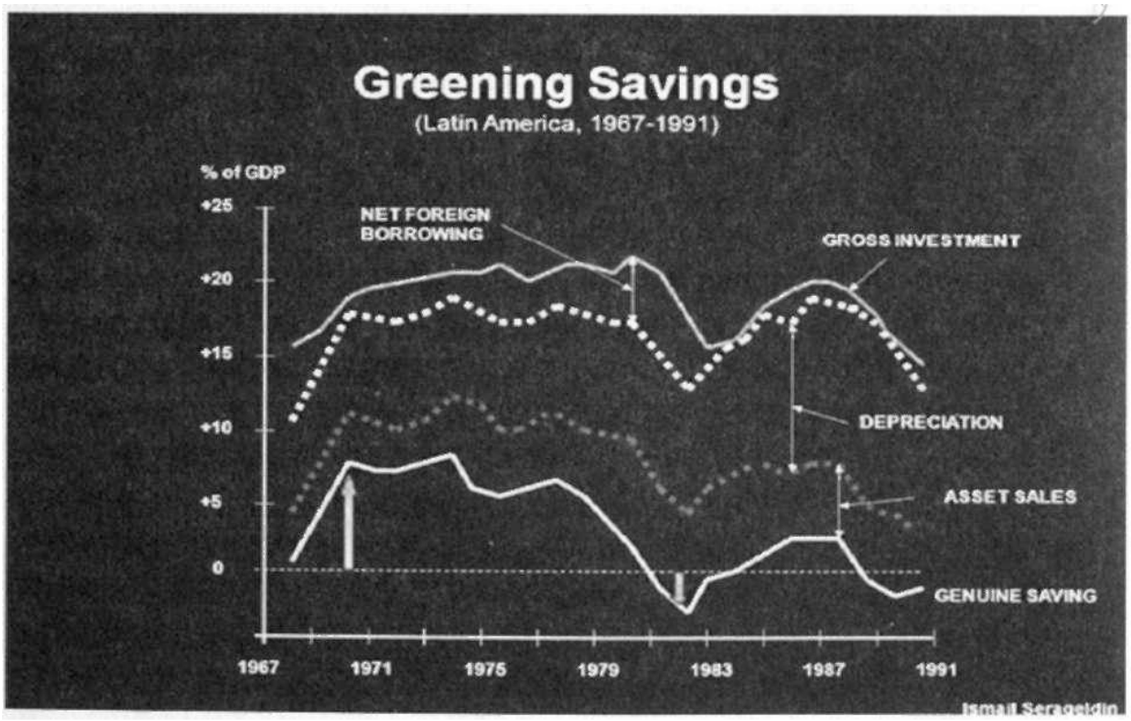

Figure 4: *Difference in Gross Investments and Genuine Savings for Latin America, 1967-1991 as percentages of GDP.*
Source: Serageldin (1996): 13

economic growth that induces very widespread false beliefs about our welfare and whether our welfare increases or not. I speak of false beliefs as the index measures economic growth in a very misleading way, not taking into account opportunities for future generations. It is probably the most important yardstick for economic policies all over the world, creating purposively false beliefs for the sake of higher stocks and higher political success, leading to higher bonuses for business leaders and greater likelihood of reelection for politicians. Given widespread public belief that economic growth is measured well and the strong short-term incentives of economic and political leaders, it seems a difficult task to change that definition in the proper direction of sustainable economic growth, bringing short-term and long-term economic growth in line with each other. Nevertheless, the next analysis shows that there are major advantages to do so.

The second, and maybe even more important, conclusion is that such a change of definition will fundamentally change both the priority order and the cognitive maps of the dominant group. If we subtract the net use of scarce natural resources from the economic growth measure, presently in use, economic growth as a goal merges with that of preservation of scarce natural resources. The conflict between short-term goal of economic growth and the long-term goal of preservation of scarce natural resources disappears as the two are forced to be in line with each other. The consequence of this is that the priority orders of the dominant group and the environmentalists become identical: sustainable economic growth has the highest priority; stability of ecosystems is second, partly because realization of the first will substantially contribute to realization of the second. In addition, the differences between the two groups in their perceptions of the relations between the issues and the ultimate goals disappear, resulting in a shared view which issue contributes to or is in conflict with which ultimate goal. The shared priorities and cognitive perceptions are visualized in Figure 5. With respect to the latter, both groups now perceive that polluting emissions reduction measures contribute to stability of ecosystems, but not to sustainable economic growth, as they tend to prolong the transition period in which scarce natural resources are overused. The money spend to pure polluting emissions reductions can better be spend on preservation of scarce natural resources, as the latter contribute both to sustainable economic growth and to stability of ecosystems. In other words, the present conflicting interests between

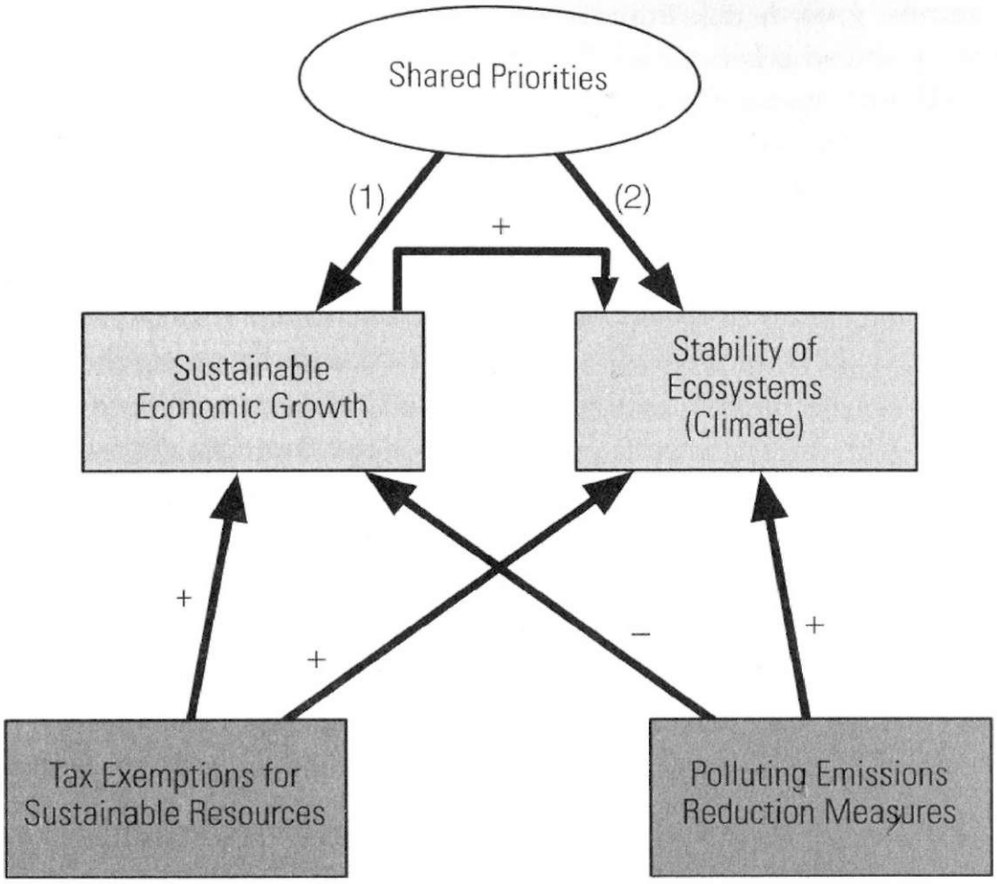

Figure 5: *Shared priorities and cognitive perceptions of relationships between issues and ultimate goals after redefinition of economic growth measure*

the dominant and environmental groups disappear, are transformed into shared interests. Conflicting interests do not longer block a quick transition towards sustainability and the only thing we have to do is to change our measure of economic growth. It will create a shared view that tax exemptions for the use of sustainable resources is a necessary instrument to boost sustainable economic growth, giving economic and political actors the right incentive at the micro level to obtain the desired macro effect of sustainable economic growth. Whereas present analyses show that there is already a positive correlation between environmental performance and economic performance (Russo and Fouts 1997), the incentives to combine the two will be much stronger and the necessary transition towards a sustainable economy much quicker.

CONCLUSIONS

Overuse of high-gain energy resources without consideration for future generations is not unique for our society. There are two important differences, however, with former complex societies.

First, the overuse is unprecedented due to the increasing world population size, the high technological capabilities, the welfare created by that, and the spread of the welfare towards Asia. This makes the disharmony between the human and the natural systems unprecedentedly large.

Second, the technological capabilities and innovations make it possible to switch to sustainable resources, and if we make this switch soon and quick enough, the loss of our welfare will likely be moderate. The technology is there; a very powerful database and search machine on patents, M.CAM (www.m-cam.com), has revealed that many large companies have patents on many sustainable technologies without using them to protect their markets. The happy side effect is that many of the patents are expired and can be used by others without any restriction.[4]

Nevertheless, the transition is not made. The first reason is the very large stakes of very powerful stakeholders in the continuation of the present production and distribution processes. The second is that the present institutions strengthen rather than correct myopia. This is particularly the case in large public corporations where bonus systems are unprecedentedly connected with short-term shareholder and profit values, whereas the older entrepreneur was mainly interested in long-term growth and profits.

The September 2008 financial and monetary crisis shows that the resulting short-term orientation of companies can be so strong that it endangers the whole functioning of the financial and monetary system. Politicians and economic leaders now realize that long-term incentives have to be enforced to repair the large damage caused by bankers who took too many risks for their own sake and that of their shareholders. We cannot prevent the present financial and monetary crisis any more, but we can still prevent a second, possibly as large or even larger future crisis in the real economy. Essential is that institutions are created that enforce an alignment of short-term goals with long term ones. I have shown that a redefinition of economic growth in which the net use of scarce natural resources is subtracted from the overall economic growth

is a fundamental clement in that reorientation. It has the following important consequences.

First, it corrects the anomaly that we can have positive short-term economic growth together with negative opportunities for economic welfare and growth in the future. The anomaly consequently creates widely spread false beliefs about our present and future welfare. As the present index of economic growth is one of the most important indicators for stockholder value and political success, the proposed redefinition brings this important indicator in line with the interests of both the present and future generations.

Second, I have shown that the present indicator of economic growth induces not only differences in priorities between the dominant and the environmentalist groups, but also differences in cognitions about the relationships between instrumental and ultimate goals. Due to the present short-term nature of the economic growth indicator, the dominant stakeholders give highest priority to short-term economic growth above preservation of scarce natural resources and stability of ecosystems, whereas the environmentalists do not. Moreover, due to the short-term nature of the index, the dominant group perceives a negative relationship between fiscal measures to preserve scarce natural resources and economic growth, whereas this is induced by an incorrect measure that falsely equate economic growth with economic streams and not with assets.

Third, if the redefinition towards sustainable economic growth coincides with tax measures promoting sustainable resources or making the use of scarce natural resources more costly, we get an alignment between political and economic stakeholders. A reduction of the use of scarce natural resources is cost effective for the economic stakeholders *and* contributes to a higher value on the index of sustainable economic growth. The latter contributes to the success and survival of politicians. The combination brings therefore the interests of the economic and political actors in line with each other, while it contributes to the level of sustainable economic growth at the macro level. As a consequence, the redefinition is very important to get a broad alignment for short-term goals that are aligned with long-term ones. It leads to a situation where shared interests dominate above the conflicting ones between the two groups!

Fourth, the resulting quick transition towards sustainability leads to a large reduction of international one-sided interdependencies as many

sustainable resources can be produced decentralized, thus making optimal use of the natural environment in the different parts of the world.

The big question is now: how can we obtain sufficient political will to introduce such a redefined measure of sustainable economic growth? Until September 2008 there was little support to be expected, due to the seemingly good operating financial and market systems, but in September 2008 it became clear to a very broad group of politicians and even economic stakeholders that long-term interests have to be better served. 1 hope to have shown that a simple redefinition of economic growth has far-reaching positive side effects and can fundamentally contribute to a transition towards a sustainable environment and climate, preventing an economic crisis within the next decades. Due to these side effects a redefinition towards a sustainable economic growth measure is of much larger importance than one would expect at first sight. I therefore advocate that the 2009 Copenhagen conference is devoted to the world-wide redefinition of the economic growth index and accompanying fiscal measures rather than focussing solely on lower $C0_2$ values through a system of emission rights. The reduction of emissions will follow automatically and quickly rather than artificially and slowly under the present regime.

NOTES

1. I thank Hanne van der lest for her contributions in the preparatory phases of this article. I thank her and Siegwart Lindenberg for their comments on earlier drafts.

2. In Figure 1 a stakeholder's utility loss of a distance between its position and the outcome is depicted as a linear function of the distance between the outcome and the policy position of the stakeholder and as symmetric around the stakeholder's policy position. We are unaware of models that take into account asymmetric utility functions around the policy position. Several models take non-linear utility functions into account, however (for example Bueno de Mesquita *et al* 1985). These non-linear extensions are based on the following class of utility functions: $U_0^{(i)} = (s_i | X_i - O|^r)$ where: $U_0^{(i)}$ denotes the utility of stakeholder *i* for outcome O, s_i and x_i denote respectively the salience and position of stakeholder *i*. If the exponent *r* is one, the utility loss is linear around the policy position of the stakeholder, if *r*<l, the stakeholder is risk taking and if *r*>l the stakeholder is risk averse. Risk taking stakeholders evaluate losses far from the (expected) outcome as less important than losses close to the (expected) outcome. For risk averse stakeholders the reverse is true.

3. These tentative alternative computations of a sustainable index of economic growth are gratefully used by a number of environmental economists. See e.g.

Mäler (2008). See for other computations of the world's ecosystem services and natural capital e.g. Costanza *et al.* (1997).

4. Nevertheless, we have here again an example where short-term goals of companies are not in line with broader long-term goals of societies. It could be corrected by introducing an institutional rule where the protection of the patent is confined to just five years if the company does not makes use of the patented intellectual property within that period.

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