Behind the scenarios: world view, ideologies, philosophies

An analysis of hidden determinants and acceptance obstacles illustrated by the ALARM scenarios

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1. Introduction

Recent forecasts predict that the world economy is set to grow by 238% by the year 2060 and the rich OECD countries by 146%, as compared to 2014 [1]. Air transport will nearly double by 2036 [2]. Biotechnology could contribute by 2030 to 50% of primary production, 80% of pharmaceutical production and 35% of industrial production in sectors where biotechnology has potential applications And Peter Johnson, SAP Marketing Strategy and Thought Leadership predicts that in the future digital economy by 2020, the average person will have more conversations with bots than with their spouse, by 2030 organs will be biologically 3D-printed on demand, and the ‘Internet of Everything’ could be worth $19 trillion over the next decade thanks to cost savings and profits for businesses and increased revenues for the public sector while 5G data speeds will be 1,000-times faster than today, offering ubiquitous connections across the ‘Internet of Things’, engagement across virtual environments with only millisecond latency, and whole new Big Data applications and services [3].

At the same time we know that if the Earth warms by three degrees Celsius (which is the trajectory under the current climate pledges), extreme events could become the normal state in the future, with the drought regions in Europe doubling from 13 % to 26 % of the total area and the
largest droughts in Europe lasting three to four times longer than in the past, affecting up to 400
million people. Lasting almost half of the year (in Spain up to 7 months), water availability will be
reduced by 35,000 m^3 H2O/km^2 of land [4], making large areas virtually uninhabitable. Most
European cities will see increases not only in heat and drought, but also in river flood risks. Over 100
cities are particularly vulnerable to two or more climate impacts while the magnitude of impacts
exceeds earlier expectations [5]. In the last two decades, one-tenth of the earth’s total wilderness
areas have been lost, an estimated 3.3 million km^2 [6] and today, 28.5% of the species analysed by
IUCN have been classified as in risk of extinction.

In the social domain, in the affluent countries GDP per capita has increased roughly 1,000%
since the 1970s, but average worker pay has increased just 11%, essentially stagnating while CEO
pay has risen 1,000%. Little wonder then that only 13% of employees worldwide are engaged,
meaning that the other 87% are not involved in, enthusiastic about, and committed to their work and
company. This is set to intensify: 75% of Millennials would take a pay cut to work for a socially and
environmentally responsible company while in a study of 100 variables, seeing purpose and value in
work was the single most important factor that motivated employees, more than compensation. It
even makes business sense: organizations in which employees perceive meaning at work are 21%
more profitable [3].

All these prognoses are based on scenarios, and they are virtually irreconcilable: rather
obviously, the rosy economic prognoses, the environmental catastrophe emerging and the social
challenges do not fit together, in particular when taking the economic impacts of the social and
environmental developments into account. Deserted countries do not grow economically, starving
populations do not consume (and least so consumer electronics), and a bioeconomy without
biodiversity is unthinkable. Nonetheless all these scenarios are promoted in a “let’s have the cake
and eat it” attitude, these contradictions are ignored. Such incompatible prognoses can even be
found in (different sections of) the same newspapers and homepages, but no sobering effect has
emerged.

However, there is one big difference between these forecasts: those promising an extended and
up-graded status quo where products and consumption patterns change but limits do not exist,
receive billions of dollars, euros, yen and yuan in investments, while those calling for damage
limitation receive miniscule funding even by governments not known for their problem denial and
scientific illiteracy. Most firms fail to take the negative trends into account (except they spot a market
niche there). For instance, Renault invests billions of euro to employ virtual reality and immersive
simulation technologies to allow its design team, partners, and suppliers to experience, interact with,
and test-drive new car designs without any physical prototypes, while car sharing could reduce the
number of cars needed by 90% already in 2035, resulting in only 17% as many cars as there are today
(Millennials are keen to share) [3].

Given that global change scenarios represent the best available knowledge of the best informed
and educated generation in the history of humankind, how can these discrepancies be explained?
Why is the world closely following the most pessimistic of the scenarios presented by the “Limits to
Growth” report almost 50 years ago [7,8]? Why always “Late Lessons From Early Warnings” [9,10]?
Environmental ignorance of economics, sociology and development theory has been accused, but if
a scenario exercise offers a doomsday variant based on incremental change and a transformation
based rescue variant, both based on the same disciplines, why is the rescue scenario lauded and the
doomsday scenario realised by decision makers in politics and business? Why is progress measured
in metrics which tell us nothing about the emerging catastrophes? [11, 12] Why do
“modificationists” do not learn from or at least listen to “transformationists” and take the hard
environmental and social facts on board? Economic interests and short term thinking may explain
part of the phenomenon, human inertia and loss aversion (the preference for the “known evil” when
facing transaction cost, i.e. change is long known, see [13] another bit. The European Environment
Agency found that even well-crafted scenarios can fail to have their intended policy impact if they
present irrelevant information, lack support from relevant actors, are poorly embedded into relevant
organisations or ignore key institutional context conditions [14]. Our hypothesis is that the world
views held by decision makers are key context conditions which – often unconsciously – make
cenarios of deep transformations appear strange, unreal, utopic. They make them appear as
expressions of illusions or idealism (as was Thomas Morus “Utopia” in 1517 [15] – but it influenced
policies) but not as real policy demands, depriving them of support from relevant actors however
good their scientific backing, the relevance of information and the embedment into relevant
organisations may be.

In section 2 we briefly describe the concepts we use in this paper (scenarios, world views,
welfare regimes) and introduce the ALARM scenarios we will use to illustrate the link between
scenarios and world views in section 3. Section discusses the results and draws some conclusions.

2. Method and Building Blocks

As so far analyses regarding the impact of underlying world views on the perception and
appeal of scenarios are missing, we focus on making the world views underlying scenarios, as well
as their social and economic implications explicit, using three archetypical scenarios from the
ALARM project [16,17]. As adopting a world view is driven by deeply held beliefs and convictions,
not least in the case of decision makers, it appears plausible that the implicit basis of scenarios
influences their perception. We will illustrate the plausibility of this hypothesis by explicating the
world views and their implications for different scenarios in section 3 to underpin out hypothesis.
As there are no quantitative data regarding the correlation of world views and the acceptance of
scenarios, our approach is limited to scenario analysis and common sense based reasoning,
illustrating the plausibility of the hypothesis. Discussing the results and drawing some conclusions,
chapter 4 we will also suggest empirical testing the hypothesis as a means to improve
environmental decision making in Europe. First, however, we try to clarify what “world views” are
in the context of our paper, drawing on philosophical discussions, before turning to scenarios in
general and to ALARM in particular.

2.1 World Views

World views are comprehensive systems of perceiving reality; which challenges are recognised,
is-ues are emphasised, policies suggested and changes endorsed in order to approach sustainable
development depends on the world views held by the respective agents. They have also been
described as ‘pre-analytic visons’, e.g. by Herman Daly et al. [18], and are similar to metaphysics. A
worldview can be expressed as the fundamental cognitive, affective, and evaluative presuppositions
a group of people make about the nature of things, and which they use to order their lives.
According to Michael Lind, a worldview is a more or less coherent understanding of the nature of
reality, which permits its holders to interpret new information in light of their preconceptions [19].

The elements constituting a world view are its ontology including an anthropology, its
epistemology and its axiology including a societal vision [20,21]. Ontology is a section of philosophy
dealing with questions concerning what entities exist or may be said to exist and how such entities
may be grouped, related within a hierarchy and subdivided according to similarities and
differences. Epistemology is the branch of philosophy dealing with the theory of knowledge; it
studies the nature of knowledge, justification and the rationality of belief. Axiology is another
branch of philosophy, encompassing a range of approaches to understanding how, why, and to
what degree humans should or do value objects, whether the object is physical (a person, a thing) or
abstract (an idea, an action), or anything else. The Dutch World Views Research Group [22] gives a
slightly different definition, including as here an ontology (and an explanation of where the world is
heading), an epistemology, and values (the axiology) but adding a praxeology or theory of action
and an etiology, reflecting on its origins and construction. We leave out the latter (although there are
good arguments for including it) as despite the emergence of a ‘reflexive modernity’ reflecting on
world views is a rare case in both scenario development and decision making – the modernity is
reflexive, but not reflective.
World views cannot be proven right or wrong but can be assessed and compared regarding their plausibility, based on their ‘fit’ with logical conclusions and with observations. Thus clashes among worldviews cannot be ended by a simple appeal to facts. Even if rival sides agree on the facts, people may disagree on conclusions because of their different premises [19]. Different value systems shape the perception of what is important in reality: from an objective value perspective, there are no instrumental values, only means to things which may be valuable; the means may be valuable in themselves but not by their mean function. From an instrumental perspective, all values are described in instrumental terms, bequest and existence value included (instrumental for enhancing one’s own life satisfaction – a ‘feel good’ or ‘warm glow’ effect, and moral nihilism). Different worldviews are associated with different value systems and different political philosophies which are appealing to one audience but can be appalling to another [23]. Accordingly, not only different decision makers, but also different scholars (and the scenarios they develop) hold and express different world views, consciously or unconsciously.

2.2 What are “scenarios”?

First of all, it appears useful to clarify what are scenarios and how they are distinct from predictions. The latter deal with certainty, requiring at least probabilistic knowledge about all possible outcomes of an event. Prognoses can be exact (A determines B with no ambiguity), or fuzzy (A determining a distribution of B), but are deterministic in both cases. Scenarios are needed when certainty is missing, which is the case for most of the phenomena relevant to economic, social and environmental development. Scenarios are based on assumptions: we assume that an accident will end our ability to work, and buy an insurance against the ensuing economic impacts; that is the case of risks. Or we know the impacts of an event (nuclear war causing global winter, greenhouse gas emissions causing climate change), but we cannot say now if the event will be happening (the nuclear war) or if an ongoing process will continue or be terminated (the case of climate change). This is the situation of uncertainty, requiring not insurance but prevention. Then there is ignorance, a situation where we know neither the probability of the event nor its potential impacts. For instance, we do not know yet if nanoparticles from plastic waste will enter the human food chain and accumulate in our bodies, and if so, which would be the resulting health impacts – this is the case for precaution. Forecasting scenarios are used to both better understand the probability of an event happening, under certain assumptions, and to explore the potential impacts, under even more assumptions; backcasting scenarios start from normatively setting a desired or feared result and analyse how it could be achieved or avoided. Thus scenarios do not predict events but are analytical tools giving indications how, again under certain assumptions e.g. regarding the policies adopted, a system will develop under status quo conditions and what can be done (and what should be avoided) to redirect the development trajectory. While in a situation of certainty predictions can be made, in cases of risk, uncertainty and ignorance we have to compare different plausible but not necessarily probable options, asking “what would happen if …?” Thus scenarios are heuristic explorative tools. Unlike predictions, they do not claim to outline the future that will be, but describe a future which might become reality. These futures must be possible and inherently plausible, but not necessarily probable as under uncertainty and ignorance probabilities cannot be quantified, by definition.

Building a scenario requires simplification to characterise the processes under analysis and support understanding them. Borrowing a phrase from Albert Einstein, scenarios should be as simple as possible, but not simpler. This poses the challenge to find a level of complexity simple enough to be comprehensible but complex enough to adequately accommodate the different options to be compared and generate answers which are relevant in a real-world context. For this behalf, a scenario is based on a narrative, a storyline which can accommodate values, subjective motivations and other qualitative elements, which is often supported by computer models to illustrate certain aspects of the scenario quantitatively. However, models are constrained to dealing with the quantifiable parameters and linear developments their equations can handle. Thus the quantitative
results always have to be interpreted – and sometimes corrected – by embedding them into the narrative context [24-26].

Unfortunately, both academic literature and press releases and media coverage often lack a clear distinction between predictions, projections, probabilistic forecasts and scenarios. Predictions are often referred to as scenarios, while certain scenarios, such as economic growth forecasts, are habitually presented as (probabilistic) predictions. Misinterpreting its scenarios as predictions was one of the main mistakes in the economists’ profession rejection of the “Limits to Growth” report almost half a century ago. Ironically, some of its worst case scenarios have turned out to be rather accurate predictions, against the best hopes of their authors [7,8] and in 2014, The Guardian published an article showing that data collected since the report’s publication supports the accuracy of the 1972 projections [27]. In the end, of course, as the world consists of different systems with different degrees of predictability, predictions and scenarios will ultimately need to come together to guide our decisions.

2.3 The ALARM Scenarios

Developing effective strategies for biodiversity preservation requires analysing all major pressures affecting biodiversity and their interaction. Scenarios developed for this behalf must be broadly based, addressing production, consumption and administration patterns and attitudes alike. This requires scenarios which deal with the effects of physical and social, of quantitative and qualitative factors in an integrative way. In the ALARM project [16], scenarios were based on storylines, and included model simulations with a range of different models to assess the impacts of multiple pressures on biodiversity.

The ALARM storylines represent a set of possible development directions, all starting from the status quo but representing different policy orientations, leading to diverging policies and results. In doing so, they illustrate that human societies have options to choose from, that biodiversity loss can be minimised, but that this requires political decisions now and in the future. The three ALARM storylines cover social, economic, environmental, agricultural, foreign, and other policies (see Table 1 and the supplementary material):

- “Business As Might Be Usual” (BAMBU) is a policy-driven scenario, i.e. a scenario extrapolating the expected trends in EU decision making and assessing their intended sustainability and biodi-versity impacts materialise. Policy decisions already made in the EU are implemented and en-forced. However, BAMBU is no business as usual scenario, based on trend extrapolation, since recent or upcoming changes in EU policies would have been ignored that way. At the national level as well, deregulation and privatisation continue except in “strategic areas”. Internationally, there is free trade. Environmental policy is perceived as another technological challenge.

- “GRowth Applied Strategy” (GRAS) is a coherent liberal, growth-focussed policy scenario. It includes deregulation, free trade, growth and globalisation as policy objectives actively pursued by governments. Environmental policies will focus on damage repair and limited prevention based on cost-benefit calculations, with no emphasis on biodiversity beyond the preservation of ecosystem services ESS.

- “Sustainable European Development Goal” (SEDG) is a backcasting (inverse projection) scenario, and as such it is necessarily normative, designed to meet specific goals and deriving the necessary policy measures to achieve them, e.g., a stabilisation of GHG emissions. It aims at enhancing the sustainability of societal development by integrated social, environmental and economic policy. Policy priorities under SEDG are a competitive economy and a healthy environment, gender equity and international co-operation. SEDG represents a precautionary approach, taking measures under uncertainty to avoid not yet fully known future damages.
Table 1: Selected policies in the ALARM core scenarios. Source: [16]

<table>
<thead>
<tr>
<th>Scenario</th>
<th>GRAS</th>
<th>BAMBU</th>
<th>SEDG</th>
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</thead>
<tbody>
<tr>
<td>Climate envelope</td>
<td>fits to the IPCC SRES-A1FI storyline and its assumptions</td>
<td>SRES A2 (the best fitting available SRES scenario at the time of calculation)</td>
<td>SRES-B1 scenario (lowest SRES scenario available, 450 ppm not in SRES. B1 and SEDG story lines differ significantly)</td>
</tr>
<tr>
<td>CAP</td>
<td>Dismantling payments for production and for 2nd pillar (rural development &amp; environment)</td>
<td>Shift 1st to 2nd pillar results in polarisation: intensification of high yielding locations, neglect of low yielding ones</td>
<td>Spatially explicit support structure to maintain (organic) agriculture throughout the landscape (only 2nd pillar transfers)</td>
</tr>
<tr>
<td>EU Funds</td>
<td>Phasing out, considered as subsidies</td>
<td>Focussed on infrastructure development and growth in poor regions</td>
<td>Focussed on local green development and opportunities, education and employment</td>
</tr>
<tr>
<td>Energy Policy</td>
<td>Efficiency, some renewables based on cost Calculations</td>
<td>Efficiency, aiming at 20% reduction of GHG emissions by 2020, 80% 2080. Increase nuclear and renewables</td>
<td>Aiming at ¾ reduction of CO2- emissions by 2050 through savings, changing consumption patterns and renewables</td>
</tr>
<tr>
<td>Transport Policy</td>
<td>Increased efficiency due to market pressure, no policy to shift the mode or even reduce transport</td>
<td>Technological improvements and changing the share of different modes of mobility (walking, biking, trains, cars, boats, planes: modal split)</td>
<td>Transport reduction priority, plus modal split change (through pricing and infrastructure supply), technical improvements</td>
</tr>
<tr>
<td>Chemicals Policy</td>
<td>Focus on innovation and competitiveness. REACH not consequently implemented</td>
<td>REACH implemented</td>
<td>REACH plus; filling gaps e.g. for metals, nanomaterials, endocrine disruptors</td>
</tr>
<tr>
<td>Trade Policy</td>
<td>Strong support for WTO and free trade</td>
<td>Promoting free trade except in “strategic areas”</td>
<td>Global sourcing reduced due to cost reasons; phytosanitarian controls</td>
</tr>
</tbody>
</table>

Developing these three options can be considered archetypical for sustainability-related scenario exercises: comparing a “muddling through” or business as usual scenario and one each representing a primacy of economic or environmental - and sometimes social – criteria, is a frequently used approach. It results in relatively similar, at least comparable scenarios based on interpretations of a set of two or three ‘standard’ world views, as table 2 illustrates. “Tools such as scenario archetypes, that is, grouping scenarios together as classes based on similarities in underlying assumptions, storylines, and characteristics, can then be used to integrate visions, thus highlighting conflicts and convergences across scales.” [28]. Thus we consider the conclusions we will draw from analysing the ALARM scenarios as not case specific but most probably more generally applicable.

In illustrating the ALARM storylines, we combined, for each of them climate scenarios from the set used by the IPCC, selected to offer the best fit with the expected climate development under the respective scenario [29]; a narrative-specific run of MOLLUSC [30], a spatially explicit land use scenario generator; and a specific set of parameters for runs of GINFORS, a highly endogenised econometric input-output model [31]. In an iterative process, the outputs and inputs to and between the models were harmonised, based on the narratives.
Table 2: Comparison of ALARM scenarios with other structurally similar global scenarios (adapted from an unpublished report for the Millennium Ecosystem Assessment)

<table>
<thead>
<tr>
<th>ALARM</th>
<th>SRES</th>
<th>GEO-3</th>
<th>Millennium Assessment</th>
<th>Ecosystem</th>
<th>Roads from Rio+20</th>
</tr>
</thead>
<tbody>
<tr>
<td>2100</td>
<td>2100</td>
<td>2032</td>
<td>2010</td>
<td>2050</td>
<td></td>
</tr>
<tr>
<td>GRAS</td>
<td>A1FI</td>
<td>Markets First</td>
<td>Global Orchestration</td>
<td>Global Technology</td>
<td></td>
</tr>
<tr>
<td>BAMBU</td>
<td>A2</td>
<td>Security First</td>
<td>Order from Strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEDG</td>
<td>B1</td>
<td>Policy First</td>
<td>TechnoGarden</td>
<td>Decentralized Solutions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>Sustainability First</td>
<td>Adapting Mosaic</td>
<td>Consumption Change</td>
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<td></td>
<td>Settele et al.</td>
<td>IPCC et al.</td>
<td>UNEP 2002</td>
<td>Millennium Ecosystem Assessment 2003</td>
<td>Kok et al. 2018</td>
</tr>
</tbody>
</table>

2.4 The Shocks

However, assuming a gradual development, i.e. no surprises, is probably the most implausible vision of the future. Thus in ALARM a methodological innovation was introduced by developing scenarios reflecting potential shocks, assuming disturbances with widespread consequences considered extreme at the time of writing. In each of the three dimensions used for sustainability concepts, the environmental, the economic and the social one, one shock is defined. A shock is any event that comes unexpectedly and has the capability to change the development trajectory of a system. The shock scenarios serve to illustrate that there can be a significant divergence of real-world developments from what linear scenarios suggest; consequently the shock scenarios could only partially be simulated in computer model runs.

The three shocks are indicated in figure 1 together with the core scenarios from which they diverge:

- **Cooling Under Thermohaline collapse** (GRAS-CUT) is the environmental shock. It describes a collapse of the Atlantic ocean water circulation (the most familiar part of it being the Gulf Stream) and the resulting relative cooling of Europe; indications observed by now.

- **Shock in Energy price Level** (BAMBU-SEL) describes the economic shock of a permanent quadrupling of the energy price, as expected when Peak Oil, the global maximum of oil production, occurs or political or other influences limit the supply significantly and permanently. We had a flavour of that in 1972, 1978 and 2008.

- **ContAgious Natural Epidemic** (BAMBU-CANE) is the social shock, a pandemic out of control. Again, we had a flavour of that, with the Chinese bird flu in 2006 and the Mexican swine flu in 2009 which permitted to observe the political and psychological mechanisms at work, regardless of their relatively limited global health impacts. In 2018, the WHO and Bill Gates, as chairman of the Bill and Melinda Gates Foundation, warn of such a pandemic being unavoidable if not imminent.

As a climate shock is most probable under the scenario generating the highest greenhouse gas emissions, it is assumed to happen under GRAS. The economic shock is attributed to BAMBU as SEDG is assuming a reduction of resource consumption which would make such a shock less probable. The social shock of a pandemic is essentially possible under all scenarios, but probably less so under SEDG which assumes a reduction of global exchange for cost reasons (see figure 1).
3. Results - Comparing the Scenarios and their Background Assumptions

The model runs, complemented by biodiversity model analyses [32] and the results from a questionnaire addressing the biodiversity experts showed that:

- GRAS consistently provides the least desirable outcome for biodiversity in Europe – across different biomes, and for most ecosystems and species.
- “Muddling through” along the BAMBU path, although probably slowing down biodiversity losses, will systematically fail to meet the EU target to end the loss of biodiversity, by 2020 and beyond.
- From a biodiversity point of view, SEDG represents a significant step in the right direction, although not sufficient in every respect (in some biomes some species and ecosystems are still lost).
- GRAS-CUT reduces the average European temperatures to the level of the early 20th century.
- Minor declines in harvest can be compensated by imports or incremental diet changes.
- BAMBU-SEL is an immediate burden on the economy which however recovers after shrinking significantly. More permanent damage is caused for the environment (by maximising biofuels) and the levels of disposable income (money flows to oil exporting countries).
- BAMBU-CANE leads to a collapse of the economy if more than 20% of the population leave their occupations to seek shelter in their countryside houses; it does not kick-start when they return.
3.1 Ideologies and the sustainability concept

Although all ALARM core scenarios represent attempts to reach sustainable development, due to their different more or less conscious but rarely explicit ideological orientations (see table 3) they diverge regarding how sustainability is operationalised.

**Table 3: Ideological orientation and institutional arrangements in the scenarios [34-36], modified**

<table>
<thead>
<tr>
<th></th>
<th>GRAS</th>
<th>BAMBU</th>
<th>SEDG</th>
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<tbody>
<tr>
<td>Ideological orientation</td>
<td>business as usual, sustained growth (macro) and profits (micro), quantitative, monetary criteria (no qualities)</td>
<td>ecological modernisation, qualitative growth, changes of aspects but not system basics, flexible adaptations</td>
<td>precaution, multi-dimensional objectives, limited win-win options, priority for justice, health and environment over net growth</td>
</tr>
<tr>
<td>Economic paradigm</td>
<td>Neoclassical</td>
<td>incoherent, neoclassical plus etatism, welfare state, technology, green growth</td>
<td>sustainability economics, ecological, evolutionary, institutional and political economics</td>
</tr>
<tr>
<td>Institutional arrangements</td>
<td>Institutions facilitating ‘corporate globalisation’ like IMF, World Bank, WTO</td>
<td>Focus on regional integration. EU a strong player in international institutions, modifying but not altering rules</td>
<td>Subsidiarity principle. e.g. strengthening the UN, evaluating where the EU needs more and where it could have less competences, and similarly so on the members state level</td>
</tr>
</tbody>
</table>

Ideology is here understood in the sense of Söderbaum as praxeology [33], an understanding how means cause results. Whereas GRAS seeks to realise what is known as weak sustainability based on substitutability between capital stocks, BAMBU considers a minimum critical natural capital indispensable, and SEDG foregoes the notion of capital stocks altogether. This has immediate implications for the understanding of sustainable development – while all scenarios pursue this objective, they define it differently (table 4).

**Table 4: Diverging concepts of sustainability in the three ALARM scenarios (own compilation)**

<table>
<thead>
<tr>
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<th>GRAS</th>
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<tr>
<td></td>
<td>Three to four capital stocks, non-declining sum, mutually substitutable (weak sustainability), the economy considered as having primacy. Processes incl. overshoot are reversible. Assumption that once the economy works properly, all other parts of the puzzle will fall in place, i.e. social and environmental problems will be solved automatically (see e.g. the Kuznets and Environmental Kuznets Curve discussion). Focus on adaptation (managing impact), optimal solutions by Maximisation.</td>
<td>Three to four capital stocks, non-declining sum plus critical natural capital, mostly comparable and commensurable, attempts to go “beyond GDP”, weak to reasonable protection standards. Precautionary principle, safe minimum standards, some ambitious protection standards set but not enforced, focus on innovation so that that the market will deliver the desired goods or fully equivalent substitutes. Focus on mitigation (reducing pressures) and restoration (stabilizing the state), optimal solutions by Optimisation.</td>
<td>Co-evolution of four sub-systems, with each having its own reproduction criteria and mechanisms, plus demands to the impacts of each other. Earth closed system with limited resources, no permanent growth possible. Precautionary principle, addressing drivers of environmental and social crises, focus on prevention (redirecting drivers) and mitigation (overcoming pressures) limiting human impact, long term resilient/healthy ecosystems providing ecosystem services. Assessment is only possible by MCA/MCDS, (socially) optimal solutions by Legitimation.</td>
</tr>
</tbody>
</table>
According to the GRAS ontology, nature and society are part of an extended definition of the economy, being described as social and environmental capital and valued as production factors. Those parts of both domains that do not contribute to production are left aside, while those that do deserve protection by policy measures, in particular the ecosystem services ESS. In the SEDG ontology, the environment is not part of the economy, but vice versa, the economy is a subsystem of society which itself is embedded in the environment. One of the direct implications of the differing ontologies is that in the first case, corresponding to the neoliberal approach, the laws of economics apply to society and the environment, while the laws of nature do not necessarily apply to the economy. This is a necessary assumption to legitimise the ignorance of the entropy law, the second law of thermodynamics, in economics.

On the other hand, if the economy is a subsystem of society which itself is a subsystem of the environment, not only the laws of thermodynamics apply to the economy just like the laws of gravity, but this is also true for the laws – or rather the rules – identified by sociology and psychology. Then enterprises are social constructs, with a lot of processes, going far beyond management, shaping their functioning and outcomes, constrained by the laws of nature.

Regarding the anthropology, GRAS follows the neoclassical approach of assuming rational decisions of the homo economicus (a necessary assumption to make equilibrium models work), complemented by a belief in the problem solving capabilities of technology: the market, and human ingenuity, will bring about the right solutions at the right time to permit frictionless development and growth. The humans populating SEDG are different, with reflection, doubt, some selfishness but also concern for others and keen to maintain the public goods and capable of sharing instead of owning.

In terms of values (axiology), while stressing the contributions to the quality of life as the basis for business ‘social license to operate’ [42,43], SEDG citizens are open to diverse definitions of what people may consider to be contributing to their respective quality of life, with value pluralism and ideas of justice as enabling all inhabitants to lead a dignified life, including fair participation in the respective society which presupposes a needs-based distribution to achieve more social equity (iustitia universalis and iustitia distributiva in the Aristotelian Nicomachean Ethics). Amongst GRAS inhabitants instrumental values dominate; they identify the value of an object according to its contributions to one’s own wealth and well-being. Equity of outcomes is no moral objective – justice is done when people are rewarded based upon what they contribute (meritocratic concept, iustitia communitativa). The three shock scenarios, when motivating demands for more ambitious precaution draw philosophically on the ‘imperative of responsibility’ by Hans Jonas: “Never must the existence or essence of man as a whole be made a stake in the hazards of action” [44](p 12). He argued: “In order to ascertain the indubitable truth, we should, according to Descartes, equate everything doubtful with the demonstrably wrong. Here on the contrary we are told to treat, for the purposes of decision, the doubtful but possible as if it were certain, when it is of a certain kind”, i.e. when violating the ‘imperative of responsibility’ [44](p. 37),[45].

3.3 The economic orientations

As a result the social visions differ, with stakeholders in GRAS relying on the market to deliver environmentally optimal solutions once externalities have been internalised. They trust in solutions to environmental problems and scarcity through better and more efficient technologies necessarily emerging in a competitive and growing market economy, while SEDG citizens call for sufficiency to complement efficiency (and make it effective by skimming off rebound gains), for respecting nature’s limits and for fair distribution of access to societal participation including to nature’s contributions to people. In SEDG the assumption prevails that economic instruments can offer incentives complementing and dynamising regulations, but that the market as such is not the a reliable means to achieve environmental sustainability.
Table 6: ALARM Economic orientations

<table>
<thead>
<tr>
<th>Source of profit</th>
<th>GRAS</th>
<th>SEDG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>Temporary, share-based</td>
<td>Permanent, individual</td>
</tr>
<tr>
<td>Level of profit</td>
<td>Fixed management objective predetermined</td>
<td>Residual, after material, labour and finance costs</td>
</tr>
<tr>
<td>Perception of corporate success</td>
<td>Achievement of management and providers of finance (shareholders), at the expense of jobs and salaries</td>
<td>Achievement of partners, sharing of results</td>
</tr>
<tr>
<td>Salaries</td>
<td>Residual after material and finance costs, plus profit</td>
<td>Negotiated costs, based on productivity increase plus inflation compensation</td>
</tr>
<tr>
<td>Relation management/staff salaries</td>
<td>Management increasing with profit or more, salaries stagnate or decline to generate profit</td>
<td>Increasing in line</td>
</tr>
<tr>
<td>Industrial relation</td>
<td>Exploitation</td>
<td>Partnership</td>
</tr>
<tr>
<td>Sustainability ethics</td>
<td>Utilitarism</td>
<td>Fairness, procedural justice</td>
</tr>
</tbody>
</table>

Consequently, substituting regulation for green taxation (the Pigouvian approach) and the privatisation, definition of unambiguous property rights and deregulation (the Coasean approach) are both part of GRAS, such instruments play a secondary role in SEDG and are used on a case by case basis – here no silver bullet exists, and each bullet can cause dangerous damages to vulnerable groups, target or not [46]. Mobilising private capital is important in both scenarios, but the means of doing so differ: while in GRAS public seed money and public-private-partnerships PPP dominate, in SEDG private investment occurs due to the necessity to react to legal standards (e.g. for emissions), regulations regarding waste treatment and recyclability standards for products. As a result, investment in GRAS follows profit maximising criteria, while the obligation driven investment in SEDG can be oriented towards investment into public goods.

The economic orientations are defined accordingly (see table 6). GRAS is a market and competition society imaginary representing a typical liberal capitalism approach while SEDG – including markets and competition, but embedding them into a social frame – pictures a postmodern, sustainability oriented society. Nonetheless it incorporates many elements of the more traditional model of “Rhenish Capitalism”, which is in line with the welfare state to etatistic socio-economic type underlying the scenario. BAMBU follows no coherent orientation but, representing EU policies, a compromise between different approaches (with the balance changing from time to time).

3.4 The social models

As social policies are part of the narratives and where appropriate the modelling, the attitudes towards social justice used in the scenarios have been based on those present in the EU. According to Opielka at the time of developing the scenarios three attitudes were dominant [36]:

- The liberal model: if interview partners supported state responsibility for securing individual income levels in at least two of the three case “illness”, “old age”, and “unemployment”, but not beyond. These preferences were implemented in GRAS.
- The welfare state model: if in addition interviewees saw state responsibility for ”reduction of income disparities”, or ”provision of jobs”, or both. This corresponds to the BAMBU scenario assumptions.
The etatistic model: if in addition they supported the control of salaries by law (implying a redistributive tax system), or a legally guaranteed general, tax financed basic income. No all but some elements were included in SEDG.

Table 7 illustrates that the three models indeed represent the attitudes of the vast majority of the European population which are significantly different from the USA (and justify a recommendation of caution when drawing conclusions from US empirical data before applying them to Europe).

Table 7: Attitudes towards social justice in Europe Data source: [36]

<table>
<thead>
<tr>
<th></th>
<th>No state responsibility</th>
<th>liberal</th>
<th>welfare state</th>
<th>etatistic</th>
<th>unclassified</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU 15 member states</td>
<td>0.5</td>
<td>8.9</td>
<td>29.8</td>
<td>56.5</td>
<td>4.4</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.7</td>
<td>20.2</td>
<td>40.9</td>
<td>34.5</td>
<td>3.7</td>
</tr>
<tr>
<td>UK</td>
<td>0.2</td>
<td>15.1</td>
<td>32.5</td>
<td>46.7</td>
<td>5.6</td>
</tr>
<tr>
<td>France</td>
<td>1.9</td>
<td>8.5</td>
<td>23.9</td>
<td>56.0</td>
<td>9.7</td>
</tr>
<tr>
<td>W.-Germany</td>
<td>0.8</td>
<td>13.7</td>
<td>46.8</td>
<td>34.0</td>
<td>4.7</td>
</tr>
<tr>
<td>CEE EU member states</td>
<td>0.5</td>
<td>4.7</td>
<td>21.8</td>
<td>69.1</td>
<td>3.9</td>
</tr>
<tr>
<td>E.-Germany</td>
<td>0.0</td>
<td>2.8</td>
<td>13.9</td>
<td>80.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2.2</td>
<td>12.1</td>
<td>24.2</td>
<td>54.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Poland</td>
<td>0.4</td>
<td>3.1</td>
<td>17.2</td>
<td>76.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.1</td>
<td>5.1</td>
<td>30.8</td>
<td>61.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0.0</td>
<td>6.7</td>
<td>12.1</td>
<td>76.7</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Despite significant differences between old and new EU member states and within each group, there is still a broad consensus that either the welfare state or the etatistic approach are what citizens want, across the political spectrum. The differences between West and East Germany were rather pronounced in the polls, but there were also important commonalities. For instance, the statement "The state must take care that everybody has a good livelihood/ a decent life ("ein gutes Auskommen") in cases of illness, need, unemployment and old age" was supported by more than 77 resp. 86% of citizens in West resp. East Germany, across all party preferences, with the liberal party FDP scoring lowest [36]. Today, with more than decade of economic development, neoliberal policy and migration, the data might be different, although the patterns probably still prevail. Gerhards and Hölscher, in their analysis of the ISSP (International Social Survey Programme) results identified the same pattern, calling the three models European Commission, social-democratic, and socialist [47].

The world views and their values shape the ways societies self-organise themselves, in particular their societal and political institutions, understood in the political sciences sense of being the rules by which political decision-making and implementation is structured (table 8). Systems of rules shaping behaviour include formal and informal value-based orientations, mechanisms to realise them and including the mechanisms for rule enforcement [48,49]. Political organisations encompass both: they are social entities, appearing as actors in political processes, as well as systems of rules, structuring political behaviour and facilitating societal orientations.

While GRAS and SEDG again are characterised by specific institutional settings shaped by the respective world views, BAMBU exhibits a mix of views due to its character as reflecting the real-world political compromises. The at least partially mutually exclusive suggestions regarding institutions on different levels confront each other in such processes – politics here often implies to reconcile the incommensurable, leading to contradictions or vagueness in policy formulations. This
was already the case for the Brundtland Report and the Agenda 21 adopted in Rio 1992, and is still true for the 2030 Agenda adopted 2016 [50,51].

Table 8: ALARM Concepts of social justice and its institutional implementation. [36], modified

<table>
<thead>
<tr>
<th>ALARM scenario</th>
<th>Concept of justice (in Aristotelian Nicomachean Ethics)</th>
<th>Institutional level involved</th>
<th>Famous representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stearing system (institutional mechanism)</td>
<td>Social relation, typology of reciprocity</td>
<td>Principle of justice (political)</td>
</tr>
<tr>
<td>GRAS</td>
<td>Equity based upon what people contribute (Iustitia Communitativa)</td>
<td>Market</td>
<td>Instrumental association, exchange</td>
</tr>
<tr>
<td>BAMBU</td>
<td>Equity of opportunity (no clear relation)</td>
<td>State (often serving business)</td>
<td>Citizenship</td>
</tr>
<tr>
<td>SEDG</td>
<td>Equity based on distribution, needs based (Iustitia Distributiva)</td>
<td>Community</td>
<td>Community Solidarity, communicative action</td>
</tr>
<tr>
<td></td>
<td>Equity based on enabling participation (Iustitia Universalis)</td>
<td>Legitimation</td>
<td>Political culture, human rights, communication of values</td>
</tr>
</tbody>
</table>

The attitudes to social justice have also shaped the welfare regimes which emerged in different parts of Europe. Esping-Andersen identified three different political economies of the welfare state (liberal, social-democratic and conservative), complex patterns of social policy, including labour market, community system, family policy and the mode of state regulation itself [52]. We used his systematique to specify the social dimension in the scenario narratives (see table 10). GRAS was designed to correlate to the liberal regime, and SEDG with some – mainly environmental – modifications to the (traditional) social-democratic (the naming chosen by Esping-Andersen pre-dates the New Labour version of social democracy). No scenario is directly related to the conservative regime as traditional conservatism has largely given way to liberal policies. BAMBU as a political compromise is again characterised by a mix of elements from different regimes.

As one result of all these divergences, some of the most politically relevant factors also diverge, such as the target groups of policy recommendations, and the justifications of the recommendations themselves, in particular the assumed resilience resp. vulnerability of the system, and the calculation off future cost and benefit (table 9). The difference in economic valuation mechanisms can be expected to contribute to and legitimate diverging policy priorities. The different ideas about dynamics, i.e. whether or not social and environmental developments are reversible, lead to different levels of precaution, and thus different policy recommendations. These are expected to appeal to different stakeholder groups – agents with a neoclassical economic background are expected to be more open for recommendations based on a similar world view, and the same applies...
for proponents of other world views which are – other than the GRAS world view – today not hegemonic.

Table 9: Additional policy shaping implications of the world views in GRAS and SEDG

<table>
<thead>
<tr>
<th></th>
<th>GRAS</th>
<th>SEDG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future value</td>
<td>Exponential discounting,</td>
<td>Object dependent: no, hyperbolic</td>
</tr>
<tr>
<td></td>
<td>positive discount rates</td>
<td>or exponential discounting</td>
</tr>
<tr>
<td>Dynamics</td>
<td>Equilibrium with reversible</td>
<td>Nature and society are processes</td>
</tr>
<tr>
<td></td>
<td>deviations, series of</td>
<td>of continuous irreversible change,</td>
</tr>
<tr>
<td></td>
<td>equilibria, largely</td>
<td>path dependent but unpredictable,</td>
</tr>
<tr>
<td></td>
<td>predictable, high</td>
<td>with medium to high vulnerability</td>
</tr>
<tr>
<td></td>
<td>inherent resilience</td>
<td></td>
</tr>
<tr>
<td>Resonance group of</td>
<td>Economic and fiscal</td>
<td>Policy makers, civil society</td>
</tr>
<tr>
<td>policy recommendations</td>
<td>policy makers, business</td>
<td></td>
</tr>
</tbody>
</table>

Besides the implications for our research hypothesis formulated in section 1, in section 4 we will point to some additional policy relevant conclusions that can be drawn from the conceptual analysis and its comparison to the empirical data upon which the scenario designs have been based.

Table 10: Welfare regimes and social justice in Europe and their representation in the ALARM scenarios [36](p. 330), based on [52], modified.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicators</th>
<th>liberal = GRAS</th>
<th>Social = SEDG</th>
<th>BAMBU</th>
<th>Conservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decommodification:</td>
<td>Level of income substitution, % of previous income. Share of individual</td>
<td>Weak</td>
<td>Strong</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>protection against</td>
<td>financing</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>market forces and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>income loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residualism</td>
<td>Share of basic support in total social expenditure</td>
<td>Strong</td>
<td>Limited</td>
<td>Medium to strong</td>
<td>Strong</td>
</tr>
<tr>
<td>Privatisation</td>
<td>Share of private expenditure for health and old age as share of total</td>
<td>High</td>
<td>Low to medium</td>
<td>Medium</td>
<td>Low to medium</td>
</tr>
<tr>
<td>Corporatism/</td>
<td>Number of social security systems for specific professions Share of</td>
<td>Weak</td>
<td>Medium</td>
<td>Medium</td>
<td>Strong</td>
</tr>
<tr>
<td>statism</td>
<td>expenditures for life-long employed government staff</td>
<td>Minimised</td>
<td>Increasing</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

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### Discussion and conclusions

#### 4.1. The science implications

Scenarios are scientific tools to support political and economic decision making. Consequently, having undertaken a deeper look into their fundamentals than usual, we can draw conclusions regarding both, science and politics.

In the scientific domain, each of the archetypical scenarios discussed comes with a specific philosophy of science related to the overall philosophical basis of the respective world view and its epistemology. While critical assessments are dominant in SEDG, in GRAS positivism dominates,

<table>
<thead>
<tr>
<th>Redistributon</th>
<th>Progression in (income) tax</th>
<th>Weak</th>
<th>Strong</th>
<th>Medium</th>
<th>Weak</th>
<th>Weak to medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equality of transfers received</td>
<td>Weak</td>
<td>Strong</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full employment guaranty</th>
<th>Expenditures for active labour market policy</th>
<th>Low</th>
<th>Strong</th>
<th>Medium</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unemployment quota, weighted by labour force participation</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role of market in social security provision</th>
<th>Shares of transfers and recipients</th>
<th>Central</th>
<th>Marginal</th>
<th>Medium</th>
<th>Strong</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Role of state in social security provision</th>
<th>Shares of transfers and recipients</th>
<th>Minimised</th>
<th>Central</th>
<th>Subsidiary to medium</th>
<th>Subsidiary</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Role of family/community in social security provision</th>
<th>Shares of transfers and recipients</th>
<th>Subsidiary</th>
<th>Subsidiary</th>
<th>Marginal to subsidiary</th>
<th>Central</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Role of human rights</th>
<th>Beyond legal status, respect in social life and employment</th>
<th>Medium</th>
<th>High</th>
<th>Medium to high</th>
<th>Medium</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Dominant form of welfare state solidarity</th>
<th>Entitlement basis</th>
<th>Individual</th>
<th>Work focussed (in SEDG incl. unpaid work)</th>
<th>Labour focusses, tax support</th>
<th>Communitarian, etatistic</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Dominant means of steering social policy</th>
<th>Agency and organising principle</th>
<th>Market, economic optimisation</th>
<th>State, equity principles for citizens/inhabitants</th>
<th>Mixed market and state, mixed ideas</th>
<th>Moral and economic</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Underlying concept of social justice</th>
<th>As realised by institutional mechanisms</th>
<th>Equality of opportunity</th>
<th>Distributional justice</th>
<th>Opportunity &amp; distribution</th>
<th>Fair participation, basic need satisfaction</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Archetypical countries</th>
<th>Switzerland</th>
<th>USA</th>
<th>Sweden</th>
<th>EU</th>
<th>Italy, Germany</th>
</tr>
</thead>
</table>
allowing scientists to claim superior truth and communicate that to decision makers. In SEDG, uncertainty is acknowledged, and the as the plurality of knowledge sources and their potential contradictions are acknowledged, legitimacy plays an important role. Hence the focus on participatory processes, discourses, participation and knowledge co-production (see table 11).

Table 11: Science and science-society relationships in the scenarios. Mode 1 and mode 2 are terms from the sociology of science, coined by Gibbons et al., referring to the way (scientific) knowledge is produced [53]. Mode 1 is characterised by a co-operation between science and society without any change in working methods of either while mode 2 is defined as a partly descriptive and partly normative way to operationalise sustainability science. Funtowicz and Strand suggested a systematique of science-society relationship distinguishing five models [35]: 1. The initial 'modern' model (perfection/perfectibility), 2. The Precautionary model (uncertain and inconclusive information), 3. The Model of Framing (arbitrariness of choice and possible misuse), 4. The Model of Science/Policy Demarcation (possibility of abuse of science), 5. The Model of Extended Participation (working deliberatively within imperfections). Post-normal science is a discursive model developed by Funtowicz and Ravetz [54].

<table>
<thead>
<tr>
<th>Theory of science, mode</th>
<th>GRAS</th>
<th>BAMBU</th>
<th>SEDG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positivism Mode 1</td>
<td>Eclectic mix, positivism dominates, Mode 1 dominates</td>
<td>Social constructivism, subjectivism, hermeneutics, contextualism, Mode 2</td>
<td></td>
</tr>
<tr>
<td>Models of science-society relationship</td>
<td>The initial 'modern' model: perfection/perfectibility</td>
<td>The precautionary model, the model of framing &amp; the Model of Science/Policy Demarcation</td>
<td>The model of extended participation: working deliberatively within imperfections</td>
</tr>
<tr>
<td>Role of scientists</td>
<td>Outside, truth speaks to power</td>
<td>different attitudes, scepticism about truth and power</td>
<td>citizen scientist, post-normal science, sustainability science, discourse based. Participatory, multi-criteria and multi-perspective</td>
</tr>
</tbody>
</table>

As in science the mode of working, the choice of methods and the selection of research questions is not an individual free choice but co-determined by external factors such as the calls and funding conditions, the preferences of journal editors and the reviewers they choose, and other institutional settings determining careers in science, the world view of decision makers in different functions is crucial for the course the scientific endeavour takes, and the advice it generates to support policy processes. Currently, it appears to be the outside world, beyond the ivory tower, which pressurises those domains where the scientific establishment rules to open up to new thinking developed by heterodox scientists over the last decades [55,56].

4.2 From science to policy – some results

What is evidence in evidence based/informed decision making? The mechanicist thinking in equilibria inherent in GRAS has been criticised for its low level of complexity which makes it virtually impossible to generate recommendations suitable as the basis for decisions in managing such complex systems as the economy, society or the environment [25]. This world view, and the neoclassical economic thinking it incorporates turn out to be a kind of Procrustean bed; Julie Nelson considers it even dangerous: „Economists seeking to disguise their value judgements under a veneer of Cartesian objectivism […] are dangerous“ [57]. The reason is not least that deriving policy advice from linear extrapolation of past events in mechanistic systems can be described metaphorically as
being like driving a car not looking for the road ahead but trying to determine the course to follow by extrapolating from what can be seen in the rear mirror.

Social aspiration discrepancy: As far as BAMBU is a realistic reflection of the current EU policies, this comparison demonstrates the divergence of EU policies and EU citizen preferences as they are obvious from table A1. Already this is an important result for European policy making, and it underscores the preference of European citizens for a rather BAMBU-to-SEDG kind of policy priorities – which of course has impacts beyond the social domain, for both economic and environmental policies.

Biodiversity conservation failure: For the EU policies this implies that although certain species and eco-systems may be stabilised under the EU policies as modelled in the BAMBU scenario, the current policies will not be able to deliver on the 2020 target, not even with delay. The shock scenarios indicate both the resilience of the socio-environmental system and its vulnerability beyond certain tipping points; currently the EU institutions are not well prepared for such shocks.

Explaining communication failures: While in the ALARM scenarios, every inhabitant in one of them shares her scenario’s world view and interacts with other agents on this basis, in the real world of course different groups endorse different world views, or, more precisely, different individuals do, strongly influenced in their decision process by their social environment (family, household, peers, colleagues, friends, role models,…). Reading the scenarios against this background also illustrates why real-world agents despite articulating similar goals cannot agree, and sometimes even enter fierce conflicts about the definition of the shared goals (rarely discussed openly) and the way and means to get there – the latter dominating the public debate. The scenarios, read as mental maps of different agents illustrate that what one may consider essential, another may perceive as effective betrayal of the common goal, and as utterly obstructive.

4.3 Policies and world views – just one example

Limits to growth, the 1972 report of the Club of Rome [7], was perceived differently in the USA, where politicians and the economics profession immediately and fiercely rejected it (Ronald Reagan famously said “There are no such things as limits to growth, because there are no limits to the human capacity for intelligence, imagination, and wonder”), while in much of Western Europe it struck a chord with the public opinion and a part of the decision makers (to these days new reports to the Club of Rome when published mention its name on the front page as this appeals to buyers in Europe, but not in the USA). The most prominent endorsement of a new world view, stimulated by the report, was probably the one of the then President of the Commission of the European Communities, Sicco Mansholt, who said in a round table statement on Oct. 14th, 1973:

“To me, the most important question seems to be: how can we achieve zero growth in this society? It is beyond doubt for me, that this zero growth must be achieved in our industrial societies, in America, Western Europe and Japan. ... Should we not succeed in doing so, then the distance, the tensions between arm and rich nations will become bigger and bigger. It would be an illusion, and even a lie to pretend there could be no growth for the Third World economies unless we were performing growth as well. I am worried however whether we will manage to get those powers under control, which strive for a permanent growth. Our whole societal system insists on growth – not only single companies, big business, multinational giants”.

However, times have been changing. To Mansholt, a GRAS scenario, its objectives and policies would have been anathema due to its focus on GDP growth, with a secondary role for environmental concerns, and even less dedication to overcome the tensions between the rich and the poor nationally and internationally. Opposed to that, his successor Jean Claude Juncker holds a GRAS world view, unshakable by environmental failures (biodiversity, climate) and social hardships (Greece, Portugal,...) – to him, an etatistic development trajectory, let alone economic degrowth are a priori unacceptable, even unthinkable. Instead “We need structural reforms […], we urgently need a boost in European investment. We need growth” describes his policy orientation, and with him much of the ruling elites in Europe today [58].
While a reconceptualization of progress is already under way as “targets for human development are increasingly connected with targets for nature, such as in the United Nations’ Sustainable Development Goals” [28] (p. 1416), most decision makers suffer from a cognitive dissonance, an unpleasant and unstable state of mind caused by the political situation. On the one hand, the threatening facts are well established, and every decision maker who does not duck to reality for a wonderland of magic thinking recognizes her responsibility (cynics claim that power is the monopoly of speech and the freedom not to listen, learn and pay attention to feedback). On the other hand, it is as well established that the established policy instruments fail to deliver on the changes necessary, while few alternatives exist in the world view held so dear for so long. Bill Rees summarises the cognitive dissonance as recognising that “The ecologically necessary is politically infeasible, but what is politically feasible is ecologically irrelevant”. The current pursuit of Green Growth by the EU, but also by the OECD and UNEP can be understood as an attempt to reconcile the incommensurable [59-61] – a political approach which can succeed in conference resolutions and conventions, but is bound to fail when the real-world implementation does not allow for the vagueness of paper work anymore [62]. Some of the erratic and inconsistent policy making can be plausibly explained by this constellation.

In a similar fashion, when the Great Recession hit the world’s economies in 2008, economists – after an initial shock period as the crisis hit them unprepared – modified their stance, endorsing selected elements of the long condemned Keynesianism, but it embedding into their own world view. While reactivating the policy instrument of deficit spending, countercyclical policies were not on the table, let alone the improvement of purchasing power by increasing salaries, both core elements of Keynesian policies. Instead the Keynesian theory was declared to be a valid receipt in times of crisis, justifying the use of heterodox instruments while declaring the own failed approach as being the right one for ‘normal times’. That following their prescriptions in such normal times had led to the disaster was fiercely denied, and the world view was thus saved from critical reflection.

4.4 Conclusion

World views do not manifest themselves as sets of axioms or deep analyses but as the stories which are the means by which we navigate the world. They allow us to interpret its complex and contradictory signals. We all possess a narrative instinct: an innate disposition to listen for an account of who we are and where we stand. When we encounter a complex issue and try to understand it, what we look for is not consistent and reliable facts but a consistent and comprehensible story. When we ask ourselves whether something “makes sense”, the “sense” we seek is not rationality, as scientists and philosophers perceive it, but narrative fidelity. Does what we are hearing reflect the way we expect humans and the world to behave? Does it fit together? Does it progress as stories should progress? A string of facts, however well attested, will not correct or dislodge a powerful story and the world view it represents. The only response it is likely to provoke is indignation: people often angrily deny facts that clash with the narrative “truth” established in their minds (they reject the epistemology to protect their ontology). The only thing that can displace a story is a story – a world view which is not able to present a comprehensive story is on the losing side of societal battles for influence.

Thus, as their core worldview shapes how they frame their arguments, people chose one scenario not for its outcomes but for the world view it represents, and the story told about it. While not being a proof, we have presented a number of analyses of the archetypical scenarios which make it more than plausible that switching the decision basis from one to the other requires a change of world views, against deeply held beliefs, routines, habits and practices – an almost impossible step as long as the world view held does not clash with reality (as is the situation today), and a difficult one even then. This is probably a suitable explanation for the failure of so many sustainability scenarios ever since the “Limits to Growth” to motivate the policy changes the recommended. If even the Great Recession was not a shock significant enough to enforce rethinking (austerity policies were reactivated soon after the first symptoms of crisis began to recede), it is hard to imagine what could cause the shift to a different world view, except a change of leadership. Scenarios will most
probably not have more power than the 2008 economic shock and thus will not be able to initiate a real change of course by the incumbents – rather they can empower those critical of the state of policies and searching for better solutions. As far as a GREEN GRAS scenario is a contradiction in terms, unearthing the hidden world views behind different policies and exposing them to the scrutiny of reality may be the only chance to enable the public at large to rethink its acceptance of policies not in line with their own world view, and support alternative positions differing from the GRAS thinking in more than individual strategies and policy instruments.

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