

# The sustainability outlook: findings in society and science

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## *Abstract*

Recently, the Netherlands Environmental Assessment Agency published a sustainability outlook consisting of a conceptual framework, a set of indicators and an outlook dealing with three themes: mobility, energy supply and food supply. The starting point for the theoretical framework was a broad definition of sustainability: the continuity of the currently preferred quality of life. Although welfare economics could be used to a certain extent, expansion in three directions was necessary: i.e. both toward the goals, toward the means and toward the forms of governance. In society, at least in Dutch society, there are no generally accepted goals for sustainability. Considering the normative character of the concept, it was decided to select some of the indicators by means of a large survey. The values derived were used for developing world views. These world views contain scenarios, in combination with empirical information on the leading values. The question of continuity was addressed by assessing the means would be sufficient for meeting the stated goals. In answering this question we were confronted with large knowledge gaps, especially in the sociological domain. Each world view contains risks of failure. More robust and sustainable strategies can be found by risk reduction.

## **1. The conceptual framework**

### *Sustainability questions*

How have we been doing? Can we continue in the same way as we are going now? These are the two main —although simply put— questions in a sustainability assessment. The policy conclusions already have been published in the sustainability outlook (MNP, 2005). Here, we are interested in the methodological issues. The conceptual framework of this assessment consists of a productive combination of existing approaches, which results in an operational assessment framework.

### *Approaches*

Four main approaches may be distinguished when considering sustainability. These are: the social-ethical approach, the needs theories, the welfare theory and the ecological approach.

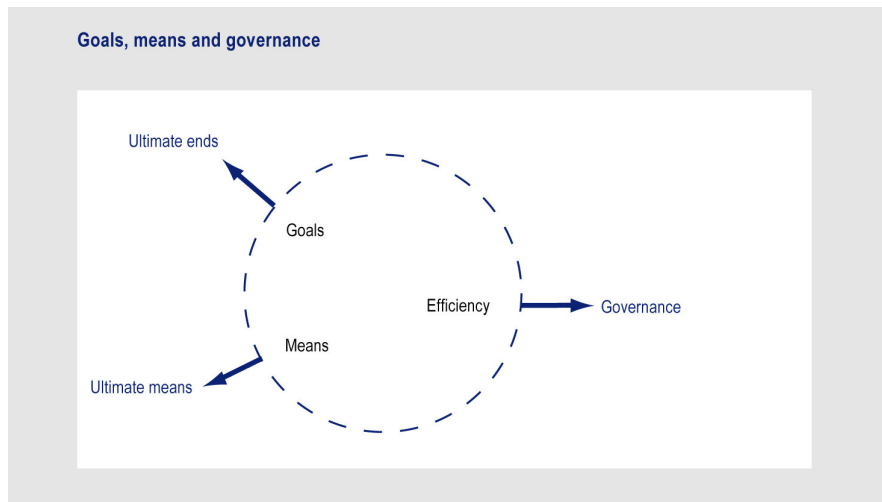
- In the social-ethical approach the focus is on the moral obligations of this generation to following generations. A 'fair' distribution of resources between *here* and *elsewhere* is also stressed (Dodds, 1997; Peet and Bossel, 2000). This moral obligation can be recognised too in the definition of sustainable development by Mrs. Brundtland.
- In the needs theories (Mazlov, 1962; Daly, 1971) higher and lower needs are assumed. Max-Neef (1992) stated this hierarchy as being not very strong. He suggested that priorities are changing continuously, shifting between such values as subsistence, protection, affection, understanding, participation and leisure. In the capability approach (Nussbaum and Sen, 1993), well-being is defined as 'the person's ability to do valuable acts or reach valuable states of being'. In recent human needs theories the interesting proposition is put forward that 'true' needs are finite, few and universal. The satisfiers of these needs may be infinite. The true needs then may be universal, with the satisfiers possibly depending on a variety of personal, social and cultural choices. Material needs are possibly the satisfiers of social and psychological needs (Jackson and Michaelis, 2003). In our sustainability assessment we chose the

concept in Rokeach (1973), who distinguished terminal values and instrumental values. These values show a strong resemblance with those of Max-Neef and others (see Table 2).

- In the welfare theory, the focus is on the distribution and allocation of scarce resources in order to reach the stated goals in an efficient way. A useful element of this theory is that improving the efficient allocation is often at odds with a reasonable or fair distribution (den Butter and Dietz, 2004). A drawback of the welfare theory is the assumption that the individuals behave autonomously and rationally in striving toward their goals. Dodds (1997) has called this the 'dubious link between preferences and state of mind'. Needs theories can be used to analyse the difference between revealed preference and 'true' needs.
- In the ecological approach, sustainability is analysed by assessing the carrying capacity of the natural system. The complex internal relationships can be mapped using system analysis. Limiting factors in the continuation of the global system can be identified. System analysis is a very useful tool in sustainability assessment. A core element in this analysis is to show the rivalry between societal goals, in which several goals can compete for the same scarce resource. Relationships between variables representing the goals and the means can be mapped using a common descriptive language. Trade-offs can then be identified.

### Conceptual framework

In the sustainability outlook sustainability is defined as *the continuity of the –here and now- chosen quality of life, given the preferred distribution of this quality around the globe and given the carrying capacity of the available ultimate means*. In contrast to existing assessments, the framework here is broadened on three sides (see Fig. 1).



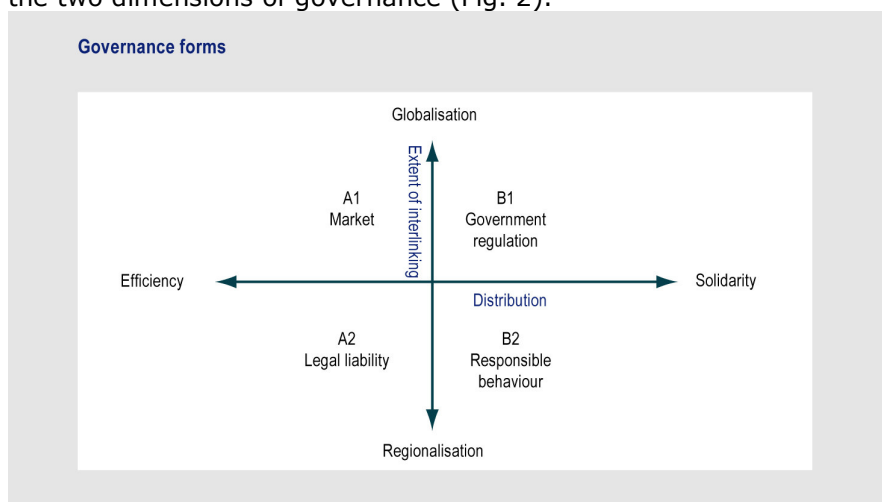
**Fig. 1** - Goals, means and governance

Goals are conceived as ultimate ends or terminal values. These underlying values can be seen as more justified indications for the needs of the next generations, because they are less influenced by short-term considerations and manipulation of preferences, for instance, through advertising.

Means are seen as the ultimate means to realise goals.

Governance is about the way the means are related to the goals. Two dimensions are distinguished here: the type of distribution and the extent of interlinking. The means can be distributed efficiently or by showing solidarity. The extent of interlinking indicates the number of social and economic interlinkages between regions, which leads in turn to a

globalised or regionalised world. Four possible governance forms can be constructed with the two dimensions of governance (Fig. 2).



**Fig. 2** - Forms of governance

## 2. The search for goals and indicators

### *Societal goals*

Sustainability goals have been defined for many countries and for many different spatial scales (regional, Europe & global). We observe that in most cases a societal goal-seeking process is not given much attention. Goal determination in sustainability is not very simple, since we are looking for ultimate ends as an indication for future needs. This process requires the participation of many societal actors, including the representatives of the different political movements. Some obstacles in this goal-seeking process are that:

- a. Ultimate ends are often difficult to express.
- b. Many issues in a sustainability debate deal with public goods, like biodiversity or global poverty. It is not sufficient to express individual goals in this debate (den Butter and Dietz, 2004).
- c. Sustainability goals are often rivals. Reducing hunger in the world can compete with the conservation of global biodiversity. When expressing goals, one must be aware of these trade-offs.
- d. Sustainability issues are not universal. The choice and prioritisation of issues is dependant, for instance, on the stage of development, the applied sustainability definition and value orientation.
- e. Goals and governance forms are mixed. One sees free trade as a goal, another sees free trade as a form of governance to reach other goals. There is a strong difference in opinion about the desirability and effectiveness of governance forms. Often, they are rooted in a political ideology. A typical example here is the discussion on the pros and cons of globalisation.

Politicians play an important role in the end phase of this societal goal-seeking process. Politicians are in charge of assessing and weighing up the societal needs against the background of the available means (den Butter and Dietz, 2004). The role of science is also important. Scientists can provide crucial information about dominant values and preferences and can also indicate trade-offs between the goals.

On the global and European scales, sustainability goals have already been determined (UN, 2000 and EC, 2001), with a number of problem analyses used as a basis. The UN also takes seven fundamentally shared values as a starting point.

However, in our opinion these goals may achieve greater public support by being tested against the leading societal values, for instance, with the help of world value surveys.

### *Indicator selection methods*

Hundreds of sustainability indicator sets exist. The scientific discussion of 'true' sustainability indicators is animated, but a debate on fundamental differences in approach is almost absent. In general, we found four different selection methods.

1. Those derived from scientific insight in the means.

In the last few decades, ecological science -with the aid of system dynamics- has gained insight into the irreversibility of processes, the exhaustion of stocks and the identification of critical levels. These insights can be used for the derivation of indicators. With these indicators, problems can be followed through time. However, these indicators only cover a part of the total sustainability domain.

2. Those derived from principles.

A lot of indicator sets are founded on previously formulated general principles, like the precautionary principle and the 'polluter pays' principle. Principles can be applied to sustainable use (Daly, 1990), conditions and limits (Azar et al., 1996), assessments (Hardy et al., 1997) or to a wide range of issues (BFS, 2003). A drawback in these methods is that the author has to make his/her choices in the number and type of principles. A lot of principles are disputable, since they are founded in a certain scientific movement or societal vision. This drawback is less, when these principles have been subject to scientific consensus processes or political decision making, as in the indicator sets of Switzerland and Great Britain.

3. Those derived from policy targets.

When explicit policy targets exist, indicators can be chosen to see if these targets will come within reach. This has, for instance, been done for the European sustainable development strategy. However, in most of the cases this approach is not possible, because explicit targets have not been formulated.

4. Those derived from human needs and values.

The needs and the cultural theories give insight into fundamental human needs. Bossel (1999) has used this, together with a systems approach, as a basis for sustainability indicators. This method is especially useful for coping with the time dimension (i.e. the future needs and the continuity of systems); please refer to next paragraph.

In our sustainability assessment we combined the methods mentioned under (1) and (4), with indicators derived from values and scientific insight. After all, the question of continuity is a matter of values (what do we want to continue?) and of scientific insight (what are the most important conditions for continuity?). The first question was tackled using a survey on Dutch value orientations. These value orientations differ in the prioritisation of terminal values (as given by Rokeach). Compared with the theoretical value studies, an advantage of this method is the empirical foundation.

The second question could be -partly- answered using scientific insights in the system relationships between means and ends. However, answering this question was quite problematic.

Hueting and Reijnders (2004) have criticised this method of indicator selection by arguing that it is incorrect to involve social actors in constructing indicators. They give the example of the fishing business, which has another opinion on the sustainable level of fish stocks than that of population biologists. They plea for 'proper' construction of indicators, where the population biologist has to supply the information on the actual and sustainable levels.

Our point of view here is that the society (and the fishing business as a part of it) can specify the goals worth striving for, and that the population biologist can analyse if the available means (the fish stocks) will be sufficient for these goals. A problem arises when goal-oriented and means-oriented indicators are added up in one single index, which will fog up rather than shed light on the sustainability issue. It is very important

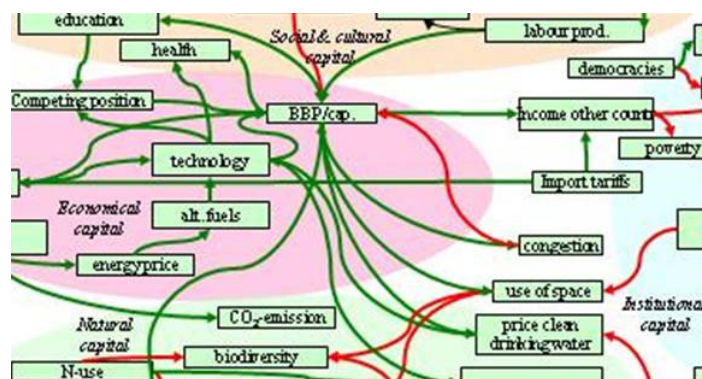
that the score on the individual indicators stays visible. This will avoid the problem described by Hueting and Reijnders.

### Limiting factors

A part of the indicator set for sustainability is formed by indicators representing the availability of the means. These 'constraints' can be seen as limiting factors for continuity. A good approach for identifying these is to model the relationships between goals and means. This approach is applicable to the ecological domain. The existence of a sufficient natural resource base, like clean water, productive soil and clean air can be identified as constraints for food availability and health. Extending this approach to the economic and social domain was problematic. For the economy, we have chosen six widely accepted growth factors. In the social domain, the knowledge on constraints is almost absent.

The knowledge gaps mentioned concern, firstly, the tracing of constraints, and secondly, the more problematic identification of the condition, i.e. the acceptable state of that constraint (Musters et al., 1998). The question on whether 'we can feed the world' is an illustration of this. What will be the minimal requirements in terms of the amount of agricultural area and clean water? In this case, the available scientific knowledge is controversial, for example, on the assumptions on the global population size, diets, yields and the role of new technology.

In modelling the relationships between the goals and the means, it was attempted to develop causal schemes. In the end it turned out that a unique scheme does not exist (see Fig. 3). Complicating factors are the multiformity of the goals, the existence of divergent logics, the large complexity and the knowledge gaps in estimating the strength of many relationships.



**Fig. 3** - Part of a try-out of a causal scheme

### Results

The main sustainability indicators for the Netherlands are listed below. Indicators representing the goals are derived from a survey on societal issues, while indicators representing the conditions are derived from scientific insight. The indicators representing the goals are given in four groups, corresponding with the four groups of value orientations, in other words, world views.

**Table 1** - Sustainability indicators. The top five priorities are very similar for the four world views, with differences occurring lower on the priority list. Some significant differences are indicated with an asterisk.

<b>Societal goals – GLOBAL MARKET</b>		<b>Societal goals – GLOBAL SOLIDARITY</b>	
Water quality Greenhouse effect National debt Healthcare * Reliable government * Competitiveness		Water quality Greenhouse effect Hunger Human rights * Availability of drinking water * Illiteracy	
<b>Societal goals – SAFE REGION</b>		<b>Societal goals – CARING REGION</b>	
Water quality Greenhouse effect Ozone layer Healthcare Pensions * Cultural differences * Public expenditure		Water quality Greenhouse effect Ozone layer Biodiversity Hunger International cooperation (fair trade) Human rights	
<b>Ecological conditions</b>	<b>Economic conditions</b>	<b>Social &amp; cultural conditions</b>	
Greenhouse effect Biodiversity Water quality Local envir. health impacts Landscape quality Use of space outside Netherl.	National debt Public expenditure Income per capita Energy price Trade flows	Global population growth National population growth Education Healthcare Pressure of work Unemployment	

Some remarkable results are that:

- Society attaches considerable weight to global ecological issues and to improvement in situations of hunger and poverty. These priorities are not very much dependant on the adopted world view. Furthermore, these priorities do not match the expectation of many policy makers.
- Means and goals cannot be fully separated. Society sees the quality of education, the national debt and the water quality as important issues. These issues are identified by scientists as important means for improving the competitiveness and the situation of hunger and poverty in the world.
- Values are associated with the preferred governance form. Those who rate performance as an important value, consider competitiveness as an important quality, and see free trade as the preferred governance form.

### 3. Developing world views

#### *Value segmentations and world views*

World views are defined as a combination of goals and governance form. In a sustainability assessment the preference is to focus on the so-called terminal values. Many social and psychological studies give us insights in terminal values of humans. Good points of departure can be found in Thompson, Meadows, Max-Neef, Bossel and Rokeach.

A small number of characteristic lifestyles have been distinguished in the cultural theory (Thompson et al., 1990). These are based on how people perceive the world and which behaviour they manifest. These lifestyles (like hierarchy and egalitarianism) are derived from values, beliefs and habits. In the TARGETS study (Rotmans and De Vries, 1997) these lifestyles were used for developing perspectives consisting of scenarios and management styles.

Meadows (1998) developed a hierarchy of means and ends. The base of the pyramid is formed by natural and known systems. The middle of the pyramid is formed

by social and less known systems in which human behaviour is described. The top of the pyramid is formed by the 'ultimate ends', such as harmony and identity.

Max-Neef (1992) named this hierarchy as not being very strong, suggesting that priorities are continuously changing between values like subsistence, protection, affection and so on.

Bossel (1999) stated that a system was sustainable when it became viable and could be continued. He describes seven basic 'orientors' of systems (existence, freedom of action, psychological needs, etc.).

Rokeach (1973) defines values as 'a type of belief, centrally located within one's total belief system, about how one ought or ought not to behave, or about some end state of existence worth or not worth attaining'. Schwartz and Bilsky (1987) see values (according to Rokeach) as 'concepts or beliefs about desirable end states or behaviours that transcend specific situations, guide selection or evaluation of behaviour and events, and are ordered by relative importance'. Rokeach distinguished terminal values (a comfortable life, real friendship, etc.) and instrumental values (ambitious, courageous, etc.)

The values and needs, as given by the various authors, show considerable resemblance (see Table 2). However, the authors think differently on the applicability. Bossel sees the basic orientors as universal basic conditions for the existence of systems. Meadows also sees the ultimate ends as universal. Thompson and Rokeach emphasise the differences in value orientations. Every orientation chooses other dominant terminal values. With the values of Rokeach it is possible to describe a value space in which clusters can be found. Each cluster represents a group of dominant values.

**Table 2** - Associations between orientors, needs, lifestyles and terminal values. Adapted (expanded) from Bossel, 1999

<b><i>Basic orientors (Bossel)</i></b>	<b><i>Psych. and social needs (Max-Neef)</i></b>	<b><i>World views (Thompson)</i></b>	<b><i>Terminal values (Rokeach)</i></b>
existence	subsistence	fatalist	family security
effectiveness	understanding/leisure	(organiser)	a sense of accomplishment
freedom of action	freedom	individualist	freedom
security	protection	hierarchist	national security
adaptability	creation	(innovator)	wisdom
coexistence	participation	egalitarian	social recognition, equality
psychological needs	affection, identity	hermit	self-respect

The terminal values of Rokeach have been used in the sustainability outlook. The main reason for choosing this approach is that these values could be empirically tested. Furthermore, we used the approach of Meadows and Daly for distinguishing the ultimate means and the ultimate ends as a basis for deriving the indicators.

#### **4. The world view analysis**

##### *Analytical steps*

The ultimate sustainability question concerns possibilities for maintaining a certain quality of life in the future. The scenario method is usually applied to exploring the future. Scenarios offer us the opportunity to explore alternative and plausible futures, taking the uncertainties that arise here into account. Our enhanced method consists of a

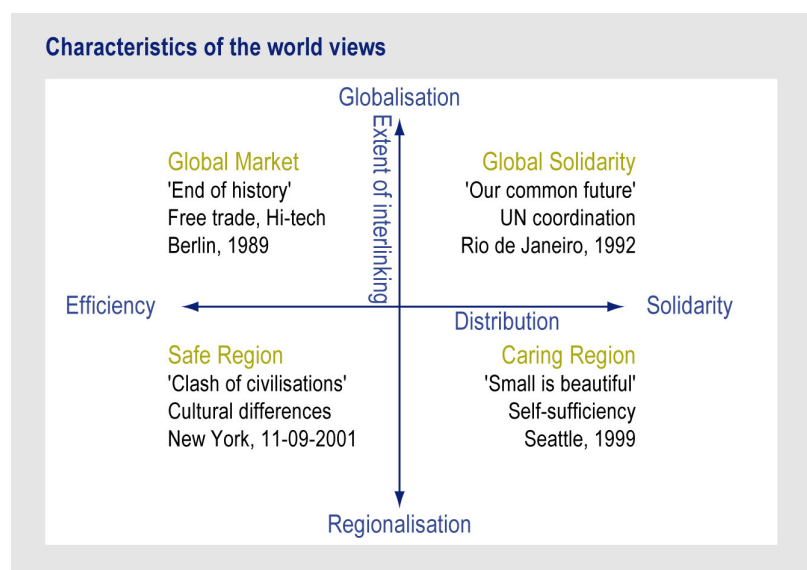
number of analytical steps applied to three themes: mobility, energy supply and food supply. These steps are:

- The development of scenarios
- The enrichment of scenarios into world views, a step providing indicators for the goals
- The identification of limiting factors, a step providing indicators for the means
- The analysis of the future impacts in the world views with the aid of model calculations
- The analysis of robustness, in which policy strategies are analysed with respect to the dominant goals in the various world views.

### *The development of scenarios*

When developing scenarios, a common method is to identify one or more axes that cover the uncertainties in the dominant drivers of the subject. The low–high technology and low–high import axes can be chosen, for instance, when developing strategies for an electricity company. In a sustainability assessment, there is a need for more general scenarios. One aspect which should, in any case, be covered is the tension between efficiency and equity. In the welfare theory, this is described as the big trade-off. This axis also spans alternate futures with respect to the global distribution of resources and alternate governance forms (market economy or government control).

Here, the IPCC scenarios (IPCC, 2000) offer a good starting point. These scenarios are widely used nowadays for economic and ecological assessments (see Fig. 4).



**Fig. 4** - World views and principal axes

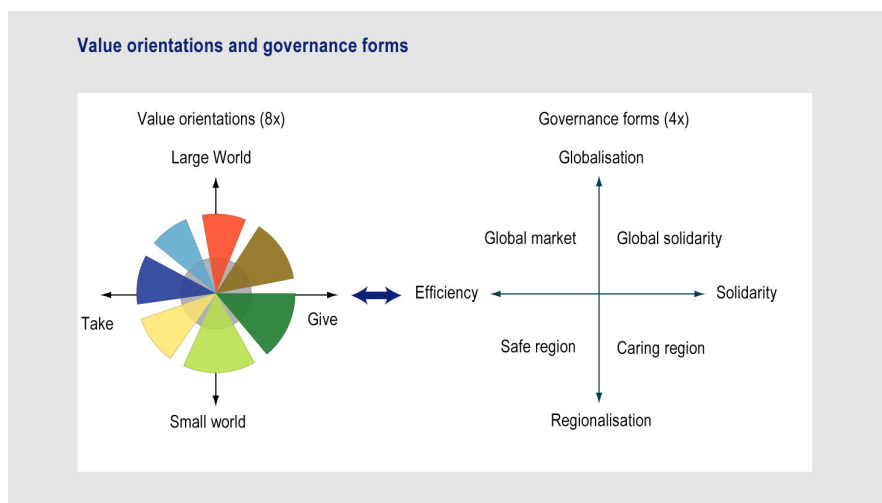
### *The enrichment of scenarios into world views*

The content of scenarios has expanded the last few decades. In the 1980s scenarios usually contained relevant trends like demography, world trade and technology. The 1990s saw an expansion of these scenarios. In the TARGETS study (Rotmans and De Vries, 1997), scenarios were expanded with perspectives, reflecting theoretical preferences of humans and institutions. With these perspectives, assumptions have been made on consumption patterns and management styles, also shown by Jackson and Michaelis (2003).

In the sustainability outlook, scenarios have been expanded further into world views. A world view is now used as an expectation regarding the future. These world views were formed by combining dominant goals (terminal values and societal issues) and a dominant governance form. It turned out to be possible to connect the world views

with political preferences. Political ideologies usually express a clear opinion on the favourite form of governance.

The various world views were thus developed using two starting points: the IPCC scenarios and the values of Rokeach.



**Fig. 5** - Principal axes in the value orientations and in scenarios

Referring to Fig. 5 we notice at first sight a striking resemblance of the principal axes to each other. Our hypothesis here is that a certain value orientation (e.g. the 'materialists') reflected a dominant preference for a certain scenario (e.g. Global Market). In a specific survey, related to this hypothesis, we asked the panel to give its favourite scenario-narrative. Indeed a correlation was found (see Table 3). It can be concluded that values partly match up with a preferred scenario. However, since we did not investigate the correlation between values and the form of governance, these are merely theoretical associations.

**Table 3** - Association between value orientations and world views

	Professionals & materialists	Hedonists & conservatives	Broad minded & socially minded	Caring faithful & conservatives	Total
	%				
A1	51	28	9	11	100
A2	26	30	14	30	100
B1	19	14	41	26	100
B2	19	22	27	32	100
Netherlands	23	23	26	29	100

#### *Hamperings to the question of continuity*

To evaluate if the ultimate means cover the stated goals, we made projections on relevant indicators. For food supply we made model calculations on among others the purchasing power in developing countries (as a proxy for combating hunger), the farmer's income (as a proxy for the material standard of living), and –on the side of the means- the global water use and nitrogen emissions. Calculating these individual indicators created no great problems. However, a broad assessment on the means and ends for achieving continuity was hampered by the following factors:

1. the identification of constraints and conditions (see section 2), and determining the relative weights of the various means towards reaching a goal.

2. the existence of many complex system relationships, trade-offs and feedbacks. For example, the global demand for water will be increased in 2030 in all world views by 15% to 60%. The dominant factors determining this increase are, however, different (in one world view the population growth is the major factor, while in another world view the economic growth is the main factor). The increasing water demand differs, in relation to this, according to the destination, e.g., drinking water, irrigation water, industry water or water for biodiversity. The efficiency of water use will increase, but this will depend on the world views. A variety of goals compete for the same scarce resource. Finally, this resource can also change in quantity as an impact of climate change.
3. The existence of various scientific paradigms, leading to different views of how the system works. For instance, the relationship between free trade, poverty in developing countries and the environment is the subject of opposing scientific opinions.

The answer to the question of continuity then is more likely to be a risk assessment, based on the various scientific opinions.

### *In search of robustness*

Rounding off the sustainability impact assessment on alternate strategies has given politicians considerable material for making decisions. If so desired, the robustness of strategies can be analysed as a last step. However, scientists are then near to entering the political arena, since they are confronting world views (and political ideologies) with each other. In any case, a robustness analysis can result in three types of options (Maas, in prep.):

- a. options that are 'no-regret', i.e. relatively cheap options, serving one goal, without negative effects on other goals (not always the most effective options). These options will be supported by all world views. An example is knowledge transfer from the Western world to developing countries.
- b. options with co-benefits for solving other problems, e.g., biomass production in the EU as an energy source (gives poor farmers an extra income and reduces the impacts of climate change).
- c. potential 'regret' options, i.e. options that can worsen the problem if seen from another world view, for example, when a trade-off exists. An example is improving the efficiency by shifting the agricultural production to low-income countries, with negative impacts on employment in the original country, on emissions from transport of goods and on the environment in the destination country.

Robustness analysis can be applied using three methods:

1. An analysis in three steps: A, B and C. World views and corresponding options are defined in A; risks are identified in B and risk-reducing response options are defined in C. Often, the supporters of an option are too optimistic about the gains. This optimism can be seen as a risk. Response options can consist of smaller adjustments to the original option, so as to reduce the negative effects on other goals. These adjustments are often rooted in an opposing form of governance (e.g., government action to correct market failures).
2. Assessment of the physical impacts of an option in the strictest world view. Here, the limiting factors will be converted rapidly into rules or standards. This analysis will give the maximum risk of failure.
3. Assessment of the robustness of an option as a combination of two factors: the improvement of the quality of life and the societal support for that option. In most cases it turned out that an option improving the most (e.g., behavioural change) has the lowest societal support, and vice versa.

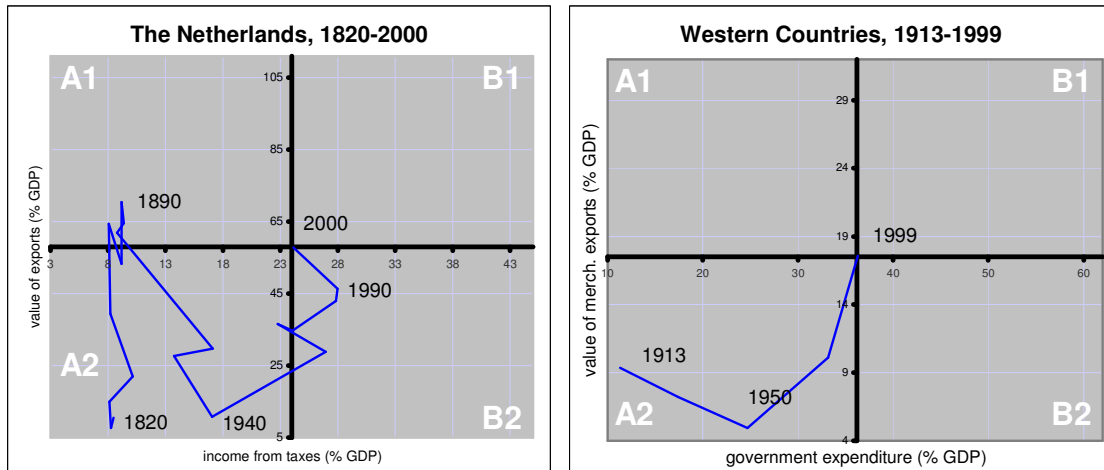
The first method (1) has been most often applied, with results proving the most useful for a political debate, since this gives information on effective forms of governance.

## 5. Some results

Apart from the general results (MNP, 2005) we present a few results here which are relevant from a methodological point of view.

### Historical trends

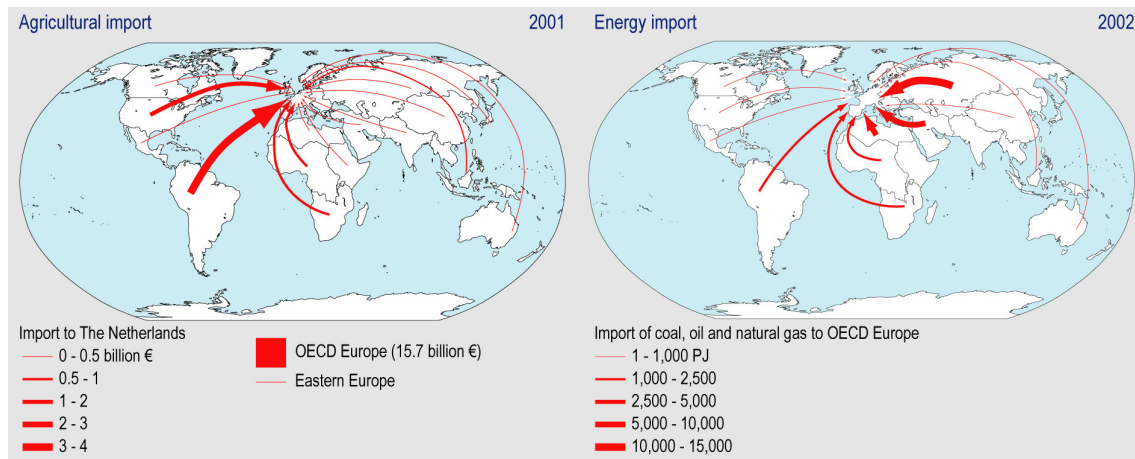
Historical trends can be analysed by choosing indicators along the axes of the scenarios (See Fig. 6). The vertical axis (the extent of interlinking) can be characterised roughly by trade flows (or by migration and knowledge flows). The horizontal axis (the type of distribution) can be characterised by the public expenditure (or by specific budgets for income redistribution). The curve shows a trend towards further globalisation and equity. A trend to a retreating government is visible in a few countries in the last decade. The economic crisis around 1930 and the Second World War form important interruptions in the trend.



**Fig 6** - Historical trends plotted in the scenario-framework for the Netherlands and Western countries (France, Germany, Netherlands, UK, United States, Japan) (Sources: van der Bie and Smits, 2001 and Maddison, 2001).

### The extent of interlinking

In terms of system analysis, a country is connected with stocks (water, oil, people, etc.) in other countries by means of monetary, physical or knowledge flows. Interlinkage maps give an insight into the spatial patterns and a good impression of the openness of the economy, migration, footprints and the exchanges of ideas between cultures.



**Fig. 7** - Food and energy imports to OECD-Europe and the Netherlands, 2001/2002 (Sources: Eurostat, 2001; BP, 2003 and IEA, 2003).

### An impact assessment on strategies

Policy strategies of societal actors can be evaluated using the sustainability indicators as criteria. Model calculations and expert judgements were used in this evaluation (see Table 3). The impact of a strategy is very much dependant on the detailed specification. For example, the effects of a biomass strategy depends on the crop type, the location of the production area and on a possible additional policy for reducing the ecological damage.

**Table 4** - Several results of the food supply assessment, indicating the effects of EU strategies on the societal goals in the different world views and on two indicators representing the means. Note: values represent improvement (+) or worsening (-) compared with the present situation.

	Luxury food availability (A1, A2)	Abatement of hunger (B1, B2)	EU food price consumers (all world views)	Global biodiversity (science)	Global emissions (science)
Less intense production, multifunctional agriculture	0	-/0	-	-	-/+
Improve efficiency, intensify production	0	0	+	-/+	-/+
Diet change (less meat)	-	+	0	++	++

## **6. Conclusions and discussion**

We think we have developed an improved method for a sustainability assessment. Although we could not give a unique, clear statement on the two main sustainability questions, we offer a structured framework for thinking and debating on sustainability. Three factors (see below) have proven to be most valuable but will need further elaboration. These are:

- The survey on values and preferences of society. The goal of the survey was to give an insight into societal preferences for sustainability. An additional survey of consumers and companies would seem useful. Furthermore, we hope that this will lead to a political reaction, since part of the role of politicians is to act as a 'preference broker' in society.

- The unravelling of goal-based and means-based indicators will help to articulate the role of science in the sustainability debate, which is primarily to make an analysis of continuity.
- The combination of scenarios and preferences, which has resulted in colourful world views, is already proving its worth in the societal and political debate. The Dutch parliament has, in the meantime, requested a follow-up of the sustainability outlook as a basis for the annual discussions on the main issues of the national governmental policy. We hope that this will lead to a form of reflexive modernisation. A major element here is a critical introspection of humans and institutions, in which they will question their own assumptions and practices. We hope this will lead to a better practice of decision-making, in which account is taken *ex-ante* of societal strategies. Giving an *ex-post* account for the choices made, or making general statements on the need for a 'balance between people, planet and profit' is less meaningful, and by some people regarded to be more like window-dressing. Sustainability, however, is all about another, less partial, form of decision-making.

### *Discussion*

We will leave you with three points for discussion, listed below.

#### Thinking and acting

Economic scientists in particular criticise the involvement of values and preferences in the analysis. They suggest the use of actual behaviour instead of stated preferences, claiming that this behaviour will vary less than preferences. Our reaction to this is to suggest that there are, indeed, a lot of barriers to converting preferences into behaviour. In many cases, this includes barriers formed by the social dilemma, in which government can play a break-through role.

#### Pluriformity

Some ecological scientists criticise the use of societal preferences in the analysis, saying that because there is only one earth, a societal debate on the continuity of the earth will only create vagueness. Science should give a clear statement on the ecological limits. We agree, of course, that there is only one earth, which is well worth preserving. However, we do think that society has a role in specifying the goals worth striving for, and scientists have their role in analysis to see if the available means are sufficient for achieving these goals. In case science is not certain on the limiting factors, we have to deal with normative choices, like a precaution strategy or a no-regret strategy.

#### Governance capabilities

Some policy makers have indicated that this assessment is based too much on the idea that a society can be managed in the right direction. They indicate that it is now much more a matter of crisis and transition management. We hope that this period of crisis management will soon come to an end, and with it, partial and short-term decisions. On transition management, our desire is to have the discussion finally move to improving the truly big issues on the quality of life.

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