Working paper for the CONSENTSUS project

The Field of Scenarios: fuzziness as a chance for building appealing future visions

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1. Introduction: futures studies in plural

1.1. Brief historical overview

Although thinking about the future is probably as old as mankind, systematic approaches to studying the future with the aim of informing debate and decision-making are essentially a post WWII phenomenon. The first scenarios are developed in the 1950's, by the US military administration, notably in the RAND Corporation around Herman Kahn. After the WWII and at the beginning of the Cold War, the context of uncertainty leads to a focus on strategic innovations such as, amongst others, new types of weapons. While the initial focus was on technological developments with potential implications for national security, futures studies also start to look at society or some constituent sector from the 1960's on. A famous example is The Year 2000 by Kahn and Wiener (1967). Rapidly, the scenario techniques enter the business world. The first documented experience is lead by the Royal Dutch Shell Company, with among others Pierre Wack. With the improvement of the computer performance and the arising of environmental concerns, global systemic models are elaborated, as the famous World3 which lead to the publication of *The limits to Growth* by *the Club of Rome* in 1972. This work applies a global perspective to development: population growth, production, consumption, resource use and environmental impacts are modelled as a dynamic system with feedback links. The report was criticised as alarmism but had an important role for the emerging environmental movement. After a relative gap in the utilisation of futures studies techniques (notably due to the fact that the

prediction of World 3 turned wrong)[1], the oil shocks and the economic crisis, scenarios made their way back as a tool for strategy building in business organisations and as a tool for R&D (technological forecast) (Bradfield et al., 2005). In France, the school of *La Prospective* was developed by Berger, Godet and others because of the alledged shortcomings of traditional forecasting (predictions based on quantitative modelling). This prospective approach can be described as holistic, mainly qualitative and taking structural change into account; there is also a strong emphasis on human volition. Another interesting 'tradition' is a strand of futures thinking that emphasizes the role of 'images of the future' for the intentions and actions of man. Pioneering work by Polak (1973) inspired several others (e.g. Boulding(1988) and Ziegler (1991)) particularly based on the presumed potential of optimistic and utopian images ('visions') of the future to inspire dedicated action. Today, there is a rich variety of futures study approaches, reflecting different aims and interests and the characteristics of different fields of application. Among others, two types of exercises brought the scenario technique at the forefront in recent years. On the one hand, we can observe the production of global scenarios, whether issue-based, mainly explorative scenarios around climate change, water, etc. (IPCC, EEA, etc.) or integrated normative visions of the future (Great Transitions), and on the other hand more local scaled scenarios focusing on the potential of development of a specific region or city, or on specific sectoral issues.

1.2. Three modes of thinking about the future

Situating the field of futures studies in the research field is not easy. In terms of practitioners as well as in terms of actual scenario approaches, one is confronted with a wide variety which Marien (2002) has characterized as "a very fuzzy multi-field" of "disconnected bits-and-pieces" which is "changing in character, along with technology, politics and culture". A great variety of terms is used in the field of futures studies: anticipating, projecting, planning, imagining, … Marien states that most futurists should describe their activity as exploring probable, possible and preferable futures and/or identifying past trends. There is conflict between the categories, however: scenario-spinners often shun attempts to forecast probable futures, those who look at probable and possible futures are often at odds with those who focus on preferred or normative futures, and those who look at trends often dissociate with other futurists. Also, the study of the future is conducted at a wide range of instances in society such as universities, special research institutes and as part of the work of authorities and companies.

According to numerous authors (Amara, 1981; Dreborg, 2004; Börjeson et al., 2006), studies of the future basically range into three categories: those that explore respectively (i) probable futures, (ii) possible future and (iii) preferable future. These three different 'future approaches' respond to three questions someone may ask about the future: 'What will happen?', 'What can happen?' and 'How can a specific target be reached?' (Börjeson et al., 2006). In response, three corresponding classical or

[1] This distrust is largely explained by a wrong interpretation of the utility of such information. World3 and Limits to Growth provided trends forecasting data, i.e. where we were heading if no profound change should occur. When we look back to this period, the main force of this report has been to initiate the debate around demography and resources use and ecological equilibrium.

even archetypal ‘modes of thinking’ have developed: the predictive, the explorative (or eventualities), and the normative (or visionary) mode of thinking (Dreborg, 2004).

The predictive mode of thinking attempts to get an indication of what will happen by trying to find the most likely development in the future, in order to be better prepared.

The explorative (or eventualities) mode of thinking is characterised by the openness to several possible events and different developments. The -strategic- purpose is to be better prepared to handle emerging situations with the idea that it is impossible to predict what will actually happen.

The normative mode (or visionary) mode of thinking means to envisage how society or some sector or activity could be designed in a better way than its present mode of functioning. This mode of thinking suggests solutions to fundamental societal problems by taking normative goals into account and exploring the paths leading to these goals.

The three modes of futures thinking identified are regarded as fundamental by several authors and this view is also maintained here; we believe these categories reflect three basically different modes of thinking about the future. They will not only serve as a basis to distinguish between different types of scenarios (see Why?-typology); to each of these modes, scenario methodologies will be related which are thus regarded as an elaborate way of utilising these modes of thinking (see How?-typology). Also, content-related items will be discussed along this line.

1.3. Scenarios

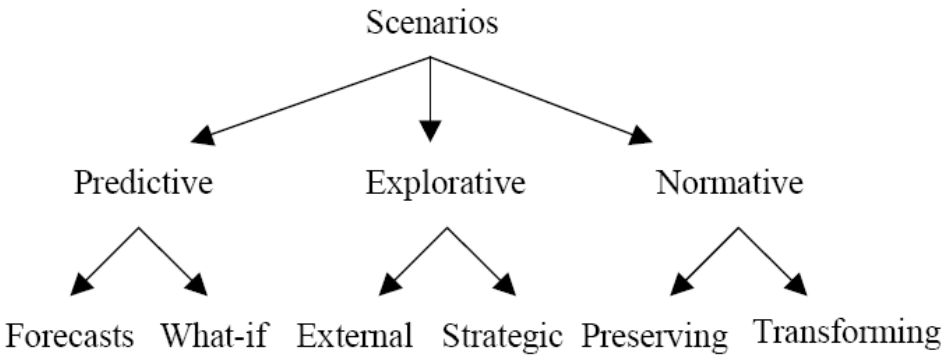
Within the field of futures studies a lot of concepts appear which are quite contested: planning, foresight, vision, image of the future… One of the most basic, but also contested concepts in this field is ‘scenario’. Early scenario developers such as Kahn and Wiener distinguish scenarios from alternative images of the future (Kahn & Wiener, 1967). Scenarios denoted a description of a future course of events, sequence of developments, often highlighting key events, decisions, or turning points (future history), whereas images of the future emphasize the final state, they describe a future set of circumstances, a portrait of the state of affairs (at a specified date or period). Nowadays both alternatives would be included under the heading of the scenario approach: some practitioners view scenarios as descriptions of possible future states, others as descriptions of future developments. Pioneer scenario developers such as Kahn and Wiener would also reject the use of scenario term in the case of predictive approaches. The fact that many practitioners use this term in a predictive sense leads us to keep a broad view on the scenario concept covering predictive approaches (based on e.g. trend extrapolation) as well as explorations of alternative futures (states as well as developments).

In summary, it is impossible to univocally delineate the field of scenario-practice mainly because it is not always clear what is done and for what reason. In the following, we will try to give a tentative answer to these questions based on different “scenario-typologies”. Several classifications or ‘typologies’ of scenarios can be developed based on the questions Why?, How? and What? A first

typology of scenario exercises (the why?-typology) is thus based on the question why scenarios are being developed. Here, this question should be understood in a broad sense of why someone would think about the future and not in a strict sense of practical usage. Such a classification is based on the different possible ways of thinking about the future mentioned above: a distinction between predictive, explorative and normative scenario studies is made here. A second typology (the how?-typology) deals with methodological issues and tries to classify scenarios according to the way they have been developed. Finally, a typology can be thought of (the what?-typology) that concentrates on the content of the scenarios; i.e. the issues that are being dealt with. In the following, these three ways of ordering the scenario field will be described. This will both give an idea of the diverseness of the field and set the conceptual contours for this project.

2. Three scenario categories, six scenario types (why? Typology)[2]

Associated with the three basic modes of futures thinking identified above, one can categorise scenarios into three broad categories: predictive, explorative and normative scenarios. Börjeson et al. (2006) further subdivide each broad category into two types as can be seen in Figure 1. In the following paragraphs this typology is developed in some detail.



Figuur 1 Scenario typology based on three basic modes of future thinking. Source: Börjeson et al., 2006.

2.1. Predictive scenario studies

Within the predictive mode of thinking, forecasts respond to the question 'What will happen, on the condition that the most likely development unfolds?', while What-if scenarios respond to the question 'What will happen, on the condition of some specified events?' The term 'what if' is used here to reflect the idea of potential effects under different assumptions (Greeuw et al., 2000).

Forecasts are conditioned by what will happen if the most likely development unfolds, i.e. when making a forecast the basic supposition is that the resulting scenario is the most likely development. Forecasts can be used as an aid for planning in, for example, the business environment. In such cases, forecasts are made of external factors[3] such as economic events, natural phenomena and organisational statistics. Those forecasts are most suited to the short term, when the uncertainty in the development of the external factors is not too great (Börjeson et al., 2006).

What-if scenarios investigate what will happen on the condition of some specified near future events of great importance for future development. The specified events can be external events, internal

[2] This section is based on a review of scenario literature and mainly on Börjeson et al. (2006)
[3] External factors are those that are not controllable by the actor or scenario user in question, contrary to internal factors such as policy measures which are at the hand of the intended scenario user to cope with the issues at stake.

decisions or both. What-if scenarios can be said to consist of a group of forecasts, where the difference between the forecasts are more like a 'bifurcation' where the specified event acts as the bifurcation point. None of the scenarios is necessarily considered as the most likely development. The resulting what-if scenarios hence reflect what will happen, provided one or more events happens (Börjeson et al., 2006).

2.2. Explorative scenario studies

Within the explorative mode of thinking, external scenarios respond to the question 'What can happen to the development of external factors?', while strategic scenarios respond to the question 'What can happen if we act in a certain way?'.

External scenarios focus on external factors beyond the control of the relevant actors. They are typically used to inform strategy development of a planning entity. Policies are not part of the scenarios but the scenarios provide a framework for the development and assessment of policies and strategies. The external scenarios can then help the user to develop robust strategies, i.e. strategies that will survive several kinds of external development. In the case of certain global climate scenarios, for example, the outcome depends on assumptions regarding how the atmosphere and the sea absorb climate gases. Completely different developments are possible depending on how those ecosystems react. The resulting scenarios then form a basis for discussions on different measures. In a business context, external scenarios can be used for companies and organisations, whose influence on external factors is obviously small, to find flexible and adaptive solutions (Börjeson *et al.*, 2006). External scenarios may also make the company more receptive to weak signals of radical changes in the actor's environment.

Strategic scenarios integrate internal factors, i.e. (policy) measures at the hand of the intended scenario user to cope with the issue at stake. The aim of strategic scenarios is to describe a range of possible consequences of strategic decisions. While external factors are taken into account, the main focus is on internal factors (i.e. factors that can possibly be affected). Strategic scenarios describe how the consequences of a decision can vary depending on which future development unfolds. Different policy approaches are typically tested and their impact on target variables are defined (Börjeson *et al.*, 2006).

These two types of explorative scenarios, by intending to span a wide scope of possible developments, resemble what-if scenarios. But the explorative scenarios are elaborated with a longer time-horizon (Dreborg, 2004; Börjeson *et al.*, 2006). Moreover, explorative scenarios typically deal with a set of structurally alternative scenarios by describing futures that differ significantly from one another (van Notten *et al.*, 2003).

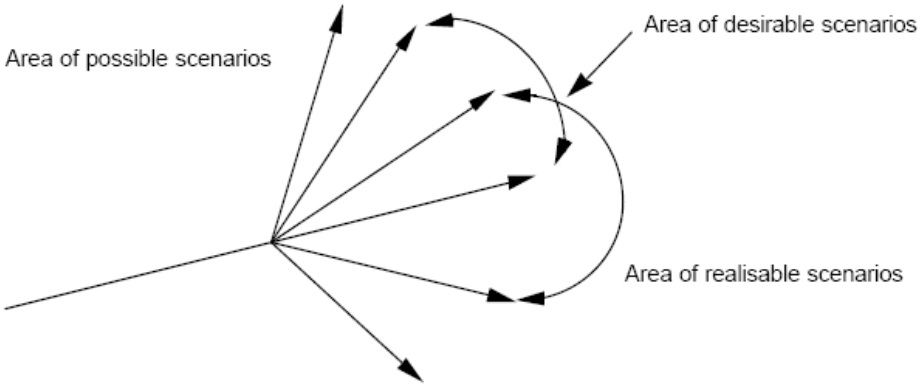
2.3. Normative scenario studies

Normative scenarios consist of two different types, distinguished by how the system structure is treated. Preserving scenarios respond to the question: How can the target be reached, by adjustments to current situation?, while transforming scenarios respond to the question: How can the target be reached, when the prevailing structure blocks necessary changes? (Börjeson, 2006)

Transforming scenarios are elaborated when a marginal adjustment of current development is not sufficient, and a trend break is necessary to reach the target. The backcasting method is mainly used (see the next paragraph on methodologies) and typically results in a number of target-fulfilling images of the future, which present a solution to a societal problem, together with a discussion of what changes would be needed in order to reach the images. It has a rather long time-perspective of 25–50 years (Robinson, 1990).

Preserving scenarios are developed to find out how a certain target can be efficiently met by adjustments to the current situation. Here, it is assumed that the target can be reached within a prevailing structure. Targets can concern environmental, social, economic, technological as well as cultural factors, typical examples being cost or eco-efficiency. Optimising the set of technology and policy measures in order to meet a certain greenhouse gas emission level is an example of a preserving scenario type as has been done in the IPCC scenarios.

In close reference to these three main scenario categories, it is interesting to look at a categorisation proposed by Godet and Roubelat (1996). They distinguish between possible scenarios, i.e. everything that can be imagined, realizable scenarios, i.e. all that remain possible when taking account of constraints, and desirable scenarios, i.e. meeting interests and values considered. It is among the realizable scenarios, which have a higher than zero probability, that we find contrasted (unlikely) scenarios and the field of development where the most probable scenarios are found. As regards desirable scenarios, these are found within the possible zone but not all are necessarily realizable. It is noticeable that most of the scenario methods concentrate on the domain of realisable or desirable scenarios. Many examples of scenario exercises claim to develop alternative scenarios whereas in fact they are at best only marginally unconventional (van Notten et al., 2003), also called ‘perturbations’ of a single business as usual future (Robinson, 2003).



Figuur 2 Categorisation of scenarios proposed by Godet and Roubelat

2.4. Concluding remarks

In conclusion, it should be stressed that this typology is an attempt to categorise the scenario field from a particular perspective, i.e. the different modes of future thinking. Any typology, however, is destined to be challenged by the (complex) reality of the scenario-practice. As discussed above, it can be for example difficult to clearly distinct what-if scenarios and explorative scenarios. Although 'pure' predictive, explorative or normative scenario studies do exist, it is to be expected that actual scenarios will not belong to just one of the categories presented above: most actual scenarios could be labelled as 'hybrids', combining in different degrees the three modes of thinking. In fact, one could think of a three-dimensional classification of actual scenarios depending on the degree of respectively predictive, explorative and normative thinking. According to Robinson (Robinson, 2003), there is a tendency for studies to use more complex approaches. The IPCC scenarios (IPCC, 2000 and IPCC, 2001) are an example of a complex approach covering predictive, explorative and normative elements and also quantitative and qualitative approaches. We will come back to this point in the next paragraph where it will be shown that methodologies, although originally attributable to one particular mode of thinking, are increasingly used in a mixed approach producing 'hybrid' scenarios.

3. How are scenarios constructed (how?-typology)

An important part of the fuzzy nature of the scenario field is linked to the multiplicity of methods used to construct products which have than various characteristics. There are probably as much methodologies and approaches to construct scenarios as there are scenario exercises. A widely reported methodology in the context of explorative scenarios, comprising five main steps, is the one described by Peter Schwartz, firstly in the book The Art of the Long View, and later on, e.g. with Jay Ogilvy for the Global Business Network (GBN) (Ogilvy and Schwartz, 2004). The five steps are the following:

1. Decision focus: Identify the focal issue or decision: What are the central concerns and key issues of the users of the scenarios?
2. Key factors: Identify the driving forces that are likely to have the most important influences on these central concerns of the future.
3. Pre-determined elements and uncertainties: Which of these driving forces seem pre-determined and inevitable and which are the factors which seems likely to change the direction of the scenarios?
4. Selecting the scenario logics (or scenario plots): Ranking of the drivers by their importance and their uncertainty and identifying two or three critical factors of the central themes of the scenarios.
5. Fleshing out. Elaborating the basic scenario logics into full-fledged scenarios. This is often done in the form of narratives that present a plausible sequence of events.

This methodological description can be found in many different variants, sometimes omitting specific steps, sometimes adding others such as the composition of the scenario team. More generally speaking and taking into account predictive and normative scenarios and hybrids, one can identify two major phases. A first phase consists of the development of the scenario logics which comprises the first four steps of the GBN methodology. In fact, the fourth step (‘the scenario logics’) is the result of the developing phase. A second phase deals with fleshing out the scenario logics into the final scenarios (enrichment, integration and consistency) and is essentially the fifth step of the GBN methodology.

The developing phase essentially consists of generating and collecting ideas, knowledge and views regarding some part of the future and structuring them into a limited number of scenario logics. Depending on the mode of futures thinking, either the “generating” work may be more paramount than the “collecting” and vice versa. This has to do with the degree of freedom, creativity and imagination a particular mode of futures thinking can be associated with. It may for instance be clear that predictive scenarios will not involve that much creativity as they are focussed on short term causal developments, e.g. extrapolating present trends and evolutions. Here, the “collection” of knowledge on existing trends

is more important. In contrast, explorative scenarios, which aim at exploring a wide scope of situations or developments that are possible to happen in a long-term perspective obviously ask for creativity in e.g. 'imagining' several alternative developments.

The fleshing-out phase deals with the elaboration of the basic scenario logics into full-drawn scenarios. The development of narratives can enrich the scenarios, while the application of systems thinking (conceptual model, quantitative model…) can deepen the scenarios and ensure both integration and consistency. It should be noted that not all scenarios are actually fleshed out by means of narrative elements. For instance, when a scenario exercise is focussing on the value-added of the process, a narrative fleshing-out of the scenario logics may not be regarded essential. This also relates to the discussion on the quantitative versus qualitative character of a scenario at the end of this paragraph.

In the following paragraphs we will relate scenario methodologies to the three modes of futures thinking. In this way, these methodologies are regarded as an elaborate way of utilising these modes of thinking. It is of crucial importance, however, that this way of presenting scenario methodologies according to one mode of thinking is not to be understood as a kind of strict recipe of what methodology to follow once a mode of thinking has been decided on. The multiple examples of hybrid scenarios rather point towards a trend for highly mixed and ad-hoc approaches, stemming from different modes of thinking. Even though one approach is dominant, sometimes a complementary technique stemming from a different mode of futures thinking can be useful. When e.g. developing several structurally different scenarios (the explorative mode of thinking), one could argue that some phenomena may be possible to predict within reasonably narrow limits. Thus predictive methods may be used to handle a segment of the phenomena studied, without changing the general explorative character of the study. Sometimes, however, methodologies representing different modes of thinking are combined on a more equal basis. For instance, the 'La Prospective Stratégique' (Godet and Roubelat, 1996)) approach combines an explorative mode of thinking for anticipation and a visionary mode of thinking for action. Actually, the most common trend in recent scenario studies is an exploratory process to raise awareness, stimulate creativity, and empower the users of scenarios before engaging, on the basis of a broad range of the resulting exploratory scenarios, a second phase of identifying the relevant and desired goal –or sets of goals- and then building the paths to reach them (Godet and Roubelat, 1996; van der Heijden, 2004). In such cases, one could say that two modes of thinking are combined, in this case explorative and normative, not just different analytical techniques. The whole perspective transcends that of a single mode of thinking. In this way, by supporting successively a social learning and a goal-oriented project, the scenario method becomes both a process as a means and a process as a goal (van Notten et al., 2003).

So, rather than presenting a strict recipe for each mode of futures thinking, this listing of scenario methodologies has to be regarded as three "toolboxes" out of which scenario developers can freely pick and combine methodologies according to the specific purpose of their scenario exercise.

3.1. Methods related to the predictive mode

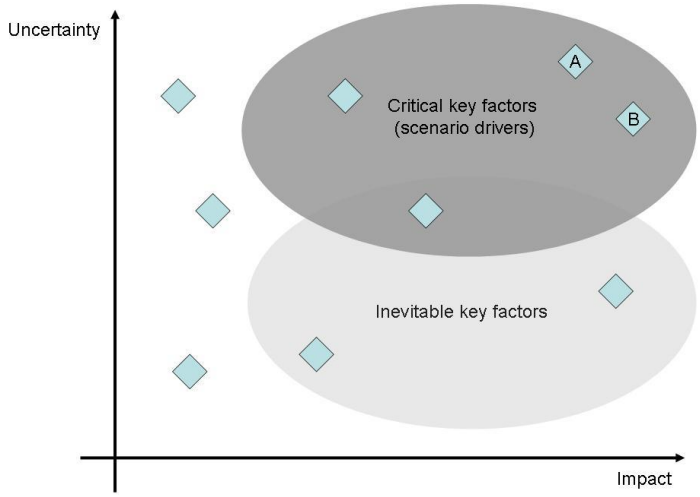
In predictive scenarios, the *developing phase* is rather subordinate and mainly relies on desk-top research in collecting and selecting the trends and issues to be dealt with. Nevertheless, when there is shortage of data or when the complexity of the problem at stake is too big, a participatory approach such as expert panels or the Delphi method can be suitable (see further on techniques).

In the *fleshing-out phase*, the predictive mode of thinking will typically imply quantitative techniques and often rely on the extrapolation of trends or the predictive modelling approach (Dreborg, 2004). The ***extrapolation of trends method*** is based on the assumption that patterns in the past will continue into the future. To perform this method, the information which has been collected about a variable in the developing phase is extrapolated to some point in the future. This analysis can be either qualitative or quantitative; the latter is often labelled as time-series analysis (see below on specific techniques). In the simplest form, trend extrapolation can be based on linear or other straightforward projections. The ***predictive scenario method*** has been specifically developed to answer scenario type 'What-If' questions (see Why?-typology). The idea is that the future cannot be only seen as an extrapolation of current trends and the aim is to analyse the effects of likely changes, as a result of which optimisation or simulation modelling are required. The scenarios mainly address policy (economic, agricultural or environmental policies) or technological changes. The use of predictive modelling often relies on computer models to represent the studied system. Different types of computer models are used in predictive modelling depending on the objective of the study: some seek mostly to explain the causes of past events, others have been designed to predict where, when or how much specific events (e.g. “extreme weather events”) will occur in the future, where some others are designed to assess a-priori how policy interventions will influence a specific event.

3.2. Methods related to the explorative mode

In explorative scenarios, the developing phase is very important due to the high degree of openness to several possible events and different developments. This also points to the need for creativity and imagination in the generation of ideas.

The *developing phase* mainly consists of brainstorming a list of key factors (internal as well as external) and selecting the most critical ones which then form the basis of the scenario logics. This assessment is based on both the level of impact (in relation to the focal issue of the scenario) of the key factors and the uncertainty regarding their outcome. Five general categories of possible forces and trends can be distinguished: social, technological, economic, environmental and political.



Figuur 3 Driving forces

In view of the further construction of real scenario logics, it is at this stage important to distinguish between key factors that seem predetermined or inevitable and those that are most likely to define or significantly change the nature or direction of the scenarios (See Figure 2). Important key factors with a low uncertainty (inevitable or pre-determined factors) should be reflected, implicitly or explicitly, in each of the scenario logics. For example, any set of scenarios about global development issues should deal with climate change, although this might assume a different shape or priority depending on political, regulatory and technological factors. New forces (value systems, ecological impacts,…) that are both very important and very uncertain are crucial for the nature and direction the scenarios take; the most important will form the backbone of the scenarios.

In a next step there has to be decided about which of these forces are most critical and will thus determine the basic premises of the final scenarios. Two somewhat different approaches can be identified in selecting the most relevant variables; one method can be described as inductive, the other deductive. The inductive method is less structured and relies on consensus building whereas the deductive approach or axes technique uses prioritization techniques to select the two most critical uncertainties.

Two variants of the *inductive approach* have been described by Ogilvy and Schwartz (2004), i.e. starting from *Emblematic Events* or from the *Official Future*. The first variant of the inductive approach starts with brainstorming individual “Emblematic Events” or plot elements. Around these different ‘seed’ events larger stories are spun. Building up scenarios from singular episodic plot elements can yield good results, but the process is unsystematic and calls for a degree of creativity and imagination that may be lacking. Also, finding consensus on which events (and thus scenario logics) are truly of paramount importance may be time-consuming and difficult. A slightly more systematic inductive approach starts from “the Official Future”: the way the future will occur according to the belief of the scenario developers. This does not necessarily have to be a BAU-scenario, in which current trends are

projected, it refers to the most plausible scenario according to the scenario developers. In a next step, the key driving forces and uncertainties of the official future are identified. Then, alternative scenario logics can be based on possible (and also surprising) changes to the key driving forces of the official story. Still, consensus has to be found on a few scenarios that are regarded as most relevant.

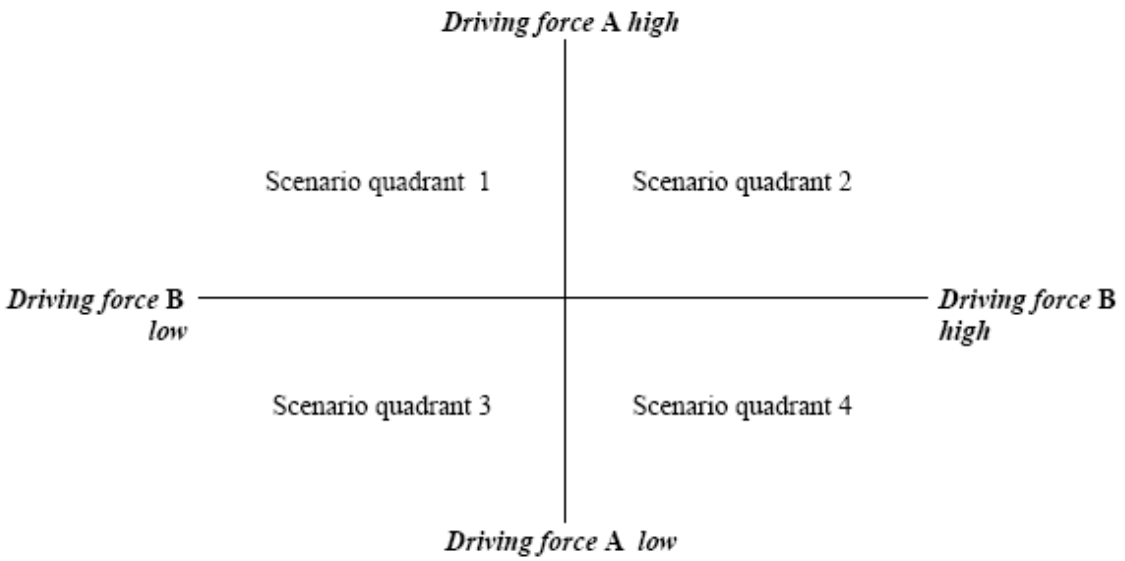
In the *deductive approach or the 'scenario axes technique'*, the idea is to prioritize the long list of key factors and driving forces in order to find the two most critical factors, both in terms of importance and uncertainty (See Figure 2). The two most critical forces then become the axes of a 2x2 scenario matrix which gives origin to 4 scenario logics; one in each quadrant of the scenario matrix[4] (See Figure 3).

The process of selecting the two most important driving forces is of particular interest as it involves a lot of implicit normative and methodological issues which are generally omitted in the discussion of scenario development. According to many scenario theorists and practitioners, the scenario axes technique provides a structured approach in which seemingly unrelated data can be made operationally useful. It is assumed that this technique, being a frame that the different actors share, fosters alignment of different perspectives despite different and often conflicting data that these practitioners are confronted with.

But this view, the '*axes as backbone for scenario development*' seems to be grounded in positivist arguments claiming that the most uncertain and important driving forces do exist ('out there') and that it is only a methodological question to retrieve them. The backbone perspective considers the scenario axes as a frame representing the essential and fundamental forces for the future and argues that fleshing out the scenarios should be done within this given frame.

Van 't Klooster en van Asselt (2006) however point out that the scenario axes do not univocally function as a unifying structure fostering alignment of different perspectives in the way that scenario theorists and practitioners often suggest. They rather argue that these two driving forces do not "exist" a priori but are the outcome of social processes: they are socially constructed (e.g. through Delphi consultation rounds). As a result of this, two other perspectives can be identified besides the backbone perspective: the (relativist) 'building scaffold' perspective and the (post-normal) 'foundation' perspective.

[4] In principle, the scenario logics could also be based on a broader spectrum, including e.g. three axes giving rise to 8 scenarios. For the sake of simplicity and communicability, it is widely believed that 2 axes is the most efficient way of working. Downsizing a long list of key factors to two may be viewed as an oversimplification and neglecting the complexity of the issue at stake. In the next step (fleshing out) however, the other key factors and the complexity involved are taken back into account when developing fully fledged scenarios.



Figuur 4 Scenario axes as a starting point for scenarios

In the '*axes as building scaffold for scenario development*' perspective, it is argued that the axes, as a result of a social construction process, should be removed once the scenario logics have been selected. This relativist perspective holds that every choice of the scenario axes is arbitrary, but at the same time acknowledges that they have a function the scenario construction process. In the building scaffold perspective the axes are merely regarded as a tool, so removing them is not problematic. Instead, removal is considered as a precondition so as to enable futurists to develop more integrated scenarios. Here, the scenario axes technique is used to make sure that the scenarios diverge sufficiently. Once divergence is established, the axes are to be abandoned. In this view, every choice of axes is arbitrary; it is seen as a mere tool to start building the scenarios.

The '*axes as a foundation for scenario development*' perspective holds a post-normal view, in between a positivist and a relativist perspective. It recognizes that the driving forces or axes are not given, nor the result of an arbitrary social process; they are the result of a deliberative choice. So, in a way, the axes are 'co-produced'; they are the social outcome of a systematic process of weighing objective arguments for and against driving forces. The foundation perspective regards this co-production process to be constitutive for the final axes chosen and thus argues that the axes can, under no condition, be removed. This perspective is closely related to the objectives of 'post-normal' science to formulate a more socially oriented process of knowledge production.

In the *fleshing-out phase* the basic scenario logics are elaborated into fully-fledged scenarios. In general, this comes down to weaving the pieces together to form an integrated narrative with a beginning, middle and an end.

While the two or three most critical driving forces have shaped the basic scenario logics that distinguish and drive the scenarios (but see the discussion on the axes technique), the other

significant factors, identified in the developing phase, can be used to enrich the scenarios. Each of the key factors and trends should be given some attention in at least one scenario; some, including the inevitable or pre-determined factors (see above), are likely to show up in all the plots. Demographic trends such as ageing population in a Belgian context or climate change for example, are likely to be implicit in all the plots, although they may have different implications depending upon how political, social and economic factors affect things as immigration or consumption. In this way, the complexity that has been squeezed out in whittling an infinite number of possible futures down to just a few basic scenario logics, can be brought back in. E.g. in the case of a 2x2 scenario matrix resulting from applying the axes technique, the other key factors that were identified can be brought back in by posing the question: “What is the value of this factor in each of the four quadrants of the matrix?”

In weaving all these pieces together, two general methods can be identified: systems thinking and building narratives. While systems thinking is good for deepening the scenario plots and ensuring consistency and coherence, narrative development is good for lengthening the basic premises into stories with beginnings, middles and ends by capturing issues of timing and path dependency.

While the narrative development is a rather intuitive approach, systems thinking, as a general denominator for studying the way parts of a system interact, presents a more structured tool for exploring the logics of a scenario. Alternating narrative development and systems thinking is thus a frequently adopted approach in scenario development. At the basis of systems thinking is a conceptual model that maps out the linkages and interactions between the elements that comprise the entirety of the system under study. In the development of the Millenium Ecosystem Assessment scenarios (see case studies), this framework links indirect and direct drivers with ecosystem services and human well-being. By keeping this conceptual framework as a constant guiding principle throughout the narrative development, all possible links (direct links, feedback loops,…) between direct and indirect drivers, ecosystems and human well-being are kept in mind (and checked) throughout the scenario development process. This also ensures the integration between ecological, cultural and other dimensions (demographic, economic, technological,…). This conceptual model, or parts of it, may then further be numerically modelled in an attempt to illustrate the scenarios in numerical form as has been done in the MEA-case (see case studies). This is one more example of a hybrid approach mixing methods belonging to the predictive mode with those of the explorative mode.

3.4. Methods related to the normative mode

In a ‘pure’ normative mode of futures thinking, one is concerned with how desirable futures can be attained, not with what futures will possibly or probably develop. The backcasting methodology has been developed for this context: it is an explicit normative approach involving working backwards from a particular desirable future end point to the present in order to determine the physical feasibility of that future and what policy measures would be required to reach that point (Robinson, 1990). During the 1970s, backcasting studies started to emerge. These typically addressed a perceived societal problem with the aim of finding a real solution. Examples are studies of the energy system and how it

could be designed without use of fossil fuels and/or nuclear power. The changes required to reach this desirable future are profound. Therefore, the development phase and especially the 'generating' part is crucial and creativity and imagination will play a big role in envisioning (steps towards) a normative vision.

In the *developing phase*, backcasting focuses on designing images of the future that show how a solution to a major societal problem may look like rather than making projections from the present into the future. Typically, the time horizon is sufficiently far off to permit real change to take place. Also, this enables thinking beyond present trends, thus stimulating creativity and making it easier to find interesting solutions. Dreborg (Dreborg, 2004) mentions this aspect as one of the prominent advances of backcasting. When images of the future have been developed, one or more paths leading from the present situation to the images are being explored. Typically, the role of policy-making is highlighted. The backcasting approaches found in the literature show differences in number of steps; they can however be summarized in three main stages (Dreborg, 2004; Hojer and Mattsson, 2000). If there are more than three steps suggested in a particular backcasting approach, it is usually possible to see specific steps as part of the three stages proposed here:

1. ***Choice of targets.*** The first step consists in designing future goals and objectives or targets. This is of course an explicit normative step. It is this particular step, the ex-ante postulation of a target that has to be achieved, which characterizes the backcasting approach as a 'pure' approach under the normative mode. In the POSSUM project, for instance, goals were – amongst others- a 25% reduction of CO_2-emissions and a reduction of public subsidies to all forms of transport to zero (see case studies for more details on the POSSUM project).

2. ***Development of images of the future.*** One or several images of the future are designed to meet the targets set in step 1. The images are tested to their goal fulfilment but also to their attractiveness, feasibility and inner consistency.

3. ***Analysis of paths to the images.*** This step requires the generation of the technological, political and economic pathways that would lead to the specified images. One important question is whether there is a need for trend breaks of some kind and how these could be realised by e.g. policy measures. These pathways need to be validated in terms of feasibility and consistency.

Typically, these steps do not follow in strict consecutive order. In particular, lessons learned in step 3 may lead to a partial revision of an image of the future (step 2). A key goal of the second step of the method is to articulate scenarios of the future that are different from conventional views of what is likely to happen. This suggests that it is important that some thought be given as to how alternative values and preferences get incorporated into the analysis. In most cases, the source of normative content of the backcasting exercise is external to the process itself (Robinson, 2003). The goals and

objectives for choosing, and evaluating, alternative desired future configurations are typically articulated 'back-office', i.e. they may come from a formal study (e.g. IPCC recommendations regarding CO_2-reduction) or from a survey of what stakeholders consider desirable. This has been the method chosen in most 'soft energy path' and 'sustainable society' backcasting studies (Robinson, 2003; Börjeson et al., 2006). In this cases, the purpose of the study was to show implications of achieving one or more normatively defined end-points, with the goal of making that information available, via publication of the results, to decision makers and the general public (Robinson, 2003).
In the early 1990s occurred a shift to participatory backcasting (Quist and Vergragt, 2006) (also called 'second generation backcasting' (Robinson, 2003)) by involving experts groups or grass-root movements and ordinary citizens directly in the process of defining and evaluating the desirability of the scenarios that are developed (e.g. Green and Vergragt, 2002).

The *fleshing-out phase* of a backcasting scenario is similar to that of scenarios under the explorative mode. Also here, external factors are to be taken into account and this will enrich the scenario. Narrative development can again be used to capture issues of timing and path dependency, issues which are of particular importance in a backcasting approach. Systems thinking on the other hand, may be useful to check the feasibility and inner consistency of the images of the future.

3.5. A brief overview of techniques used in scenario construction

In this paragraph we want to give a brief overview of some concrete techniques that are being used in current scenario work. Besides storytelling (the narrative approach), techniques can mainly be grouped in two main categories: one category contains all kinds of participatory techniques, the other deals with modelling techniques.

3.5.1. Participative approaches

As we have seen in the above description of the scenario field, *participative approaches* are being used in different stages of the scenario development and are mainly used for generating and structuring ideas and/or opinions. We briefly describe a few common techniques such as brainstorming, workshops and Delphi; an extended overview of participatory tools can e.g. be found in the Viwta/KBS Participatory methods toolkit (Steyaert and Lisoir, 2005) and the Seamless report (Bousset et al., 2005).

Brainstorming is a well-known technique for the creative generation of ideas without taking into account constraints such as feasibility or cost. Therefore, participants are asked not to criticise, discard or disparage any ideas generated by others, but are instead encouraged to build on them (Bousset et al., 2005).

All kinds of *workshops* can facilitate broadening of perspectives, since decision-makers, stakeholders and experts can be included in the process. A workshop is a kind of idea seminar where participants elicit and structure ideas following an elaborate method. One example are the workshops used in the

scenario planning process by van der Heijden (1996). In a process of identification of events, clustering them and searching for causalities, driving forces are identified by revealing the underlying structure of events. The Emblematic Events or Official Future approaches discussed in the developing phase of explorative scenarios are examples of approaches that can be elaborated in a participatory workshop. Techniques that stimulate creative thinking such as brainstorming are often included in the workshop process.

The main idea of the *classical Delphi* method, originally developed by the RAND corporation in the 1950s, is to collect and harmonize the opinions of a panel of experts on the issue at stake. It recognizes that the judgement of a number of informed people is likely to be better than the judgement of a single individual. As such, it regards human judgement as a legitimate input to e.g. forecasts. The classical Delphi method can be said to be a multi-round expert survey with the aim of reaching consensus among the experts regarding the development of certain key factors. The result is thus a consensus forecast or judgement and Delphi is therefore regarded as a quick method for getting the information needed for making decisions. The fact that consensus is strived for has generated a lot of criticism in particular on the inevitable loss of important information. In the context of explorative scenario development, a *modified Delphi* method has been elaborated by Best et al. (1986). Here, different groups of opinions are identified after the first round of questionnaires. Within these groups, a classical Delphi-process is then followed in order to arrive at meaningfully different but coherent futures. A Delphi-like process has also been used in a backcasting approach developed by Höjer (1998) and has appropriately been termed *Backcasting Delphi*. Here, the Delphi experts are asked to evaluate and improve the images of the future in respect of their feasibility and coherence to the defined target.

3.5.2. Modelling techniques

Modelling techniques are mainly used in the fleshing out phase, either as a predictive tool (predictive mode) or as a tool to check the consistency and coherence of a scenario plot (explorative and normative mode). In doing so, it can moreover illustrate the final scenarios with quantitative data. Here, we distinguish three subgroups of such numerical models: time-series analysis, explanatory modelling and optimising modelling. The focus in these techniques is on projecting some kind of development with more or less explicit constraints.

Time-series analysis is a quantitative technique to make forecasts by extrapolating one variable into the future based on historical values of this same variable. The system in question is treated as a black box. The underlying causes of development are not in focus, either because they are too difficult to analyse, or because the results are given higher priority than the behaviour of the system. This technique is e.g. used to predict the size of human populations.

In *explanatory modelling* inter-relationships between variables are taken into account by projecting not variables but relationships into the future. It is thus based on causal links in the form of equations

connecting variables and consists of a quantitative description of the mechanisms and processes that cause the behaviour of the system. To create this model, a system is analyzed and its processes and mechanisms are quantified separately. The model is built by integrating these descriptions for the entire system. A specific model can thus only produce scenarios within a given system; by changing the causal links, a new model with a new system structure is developed (Börjeson, 2004).

Optimising modelling is a useful technique to represent human decision-making processes (Lambin et al., 2000). As in explanatory modelling, optimising models also project relationships between variables into the future but have an explicit optimising aim. They seek to describe what should be done based on a set of pre-determined goals and concerns. A lot of mathematical optimization techniques exist aiming at maximizing or minimizing some kind of utility or cost (e.g. profit maximisation). Optimizing models are limited by their inability to describe dynamic processes (change through time).

As an illustration of the highly complex methods that are being used in the scenario development field, *participatory modelling*, being a combination of participatory and modelling approaches, can be mentioned. In participatory modelling, the modelling environment, model formulation, and model development must be transparent and within the grasp of the participating stakeholders (Mendoza et al., 2004). This is in contrast with traditional modelling approaches, which are often limited to scientists with technical expertise.

3.5.3. Storytelling – narrative approach

As already mentioned, a narrative approach may enrich the scenario 'skeleton' with 'flesh and blood', that is, living, detailed and consistent storytelling. *Storytelling*, according to amongst others Rasmussen (Rasmussen, 2005), is also an excellent method weaving together the relatively certain aspects of the future with imagination about the uncertain: scenario stories have the ability to transmit both rational and creative layers of thoughts and belief, they help us to make sense of what has been, what is and what might be.

Rasmussen further makes an essential distinction between *storylines* and *plotlines*. A storyline consists of essential events (essential in relation to the issue at stake) in a causal relationship; it describes events occurring within the time frame of the scenario. While storylines are causal relationships between events that set out a movement towards fulfilment of the story's promise, a story's plotline is the events that make the story advance along its storyline in a dramatic and compelling way. As the storyline's events make the story progress along its storyline, the events on the plotline operate to dramatically heighten that advance. In other words, a coherent configuration of the different storylines makes up the scenario skeleton while the plotlines serve as 'flesh and blood'.

It is important to make this distinction, as it allows for the qualification of bad scenarios on two levels. On the one hand you find bad scenarios that have poor storylines failing to convey the core ideas despite of a lot of appealing plotlines and on the other hand a lot of scenarios do not seem to have any

plotlines, failing to bring an appealing and compelling story. Indeed, one of the strengths of 'rich' scenarios is that they may appeal to the human being as a whole creature: senses, emotions, thoughts, behaviours and so on. A lot of scenarios however, as Rasmussen appropriately points out, seem to be made without a plotline: 'dry' stories without any sensuous or emotional descriptions. The Millenium Ecosystem scenarios are an example of such a lack of plotlines, perhaps due to an undue focus on the purely logical and rational relationships between the events to make the points as analytically clear as possible. It is also possible to create a scenario with a lot of appealing plotlines which are however not rooted in the deeper story issues. Very dramatic stories in which the plotlines are strong but the story lines are weak may have difficulties in transferring the core ideas to its audience. The dramatic actions may not 'ring true'; they will be perceived as pure entertainment as they lack a clear connection to the central assumptions and ideas.

It is not easy to find an example of a scenario that has both strong storylines and plotlines. There even seems to be a trade-off at work between both: Either, scenario's focus on the rational and logical aspects (e.g. explicitated in a conceptual framework) which seems to work as a straitjacket curtailing the imagination and creativity needed to come up with compelling plotlines or, vice versa, the focus is on creating original, memorable, provocative and compelling with the risk of loosing hold of the underlying core messages. One of the major challenges in future scenario-work may well be situated in overcoming this dichotomy.

3.6. Concluding considerations on methodology

In conclusion of this overview we briefly discuss a few central methodological characteristics which are worth some extra consideration if one is to engage in an actual scenario construction process.

3.6.1. On quantitative versus qualitative approaches

Whether the scenario developers chose to use mainly modelling approaches or storylines approach, the method can be characterised as respectively *quantitative* or *qualitative*. Qualitative scenarios describe possible futures in the form of words rather than numerical estimates, whereas quantitative scenarios provide needed numerical information in the form of tables and graphs. Before listing advantages and disadvantages it is interesting to observe that in a major part of the scenario literature, a narrative fleshing out is regarded as an essential characteristic of a scenario. This view can hardly be maintained within our broad scenario concept, especially as it includes predictive approaches. However, for scenarios which adhere to the explorative or normative mode, it seems crucial that at least *the idea* of a coherent story or image of the future of the system under study has to be there, even if it is not made explicit in a real narrative story.

The main advantage of qualitative scenarios seems to be situated in the "interpretive flexibility" quality of narratives (Smith and Kern,2007). Such a scenario can integrate disparate ideas, thoughts and feelings of several different stakeholders into one holistic image while at the same time reflecting uncertainties, incorporating surprise and account for human volition. Also, well-written narratives with both strong storylines and plotlines may present an understandable and compelling way of communicating information about the future as they enrich the scenario 'skeleton' with 'flesh and

blood', i.e. living, detailed and consistent storytelling. The main disadvantage is that qualitative approaches do not, by definition, satisfy a need for numerical information.
Modelling on the other hand, as the principal approach for quantitative scenarios, is mainly criticized for containing many implicit assumptions about the future as models tend to represent only one point of view about how the future will unfold. In this way, models produce scenarios that are unnecessarily narrow in view. This point of critique is sometimes countered by the argument that the assumptions behind models are at least made explicit in the form of model equations, parameters and coefficients contrary to qualitative scenarios, where most of the assumptions remain locked in the heads of the scenario developers. Another advantage of model calculations is their internal consistency which makes them useful tools for checking the consistency and coherence of qualitative scenarios, at least those parts which can be modelled. A last point of comparison between qualitative and quantitative approaches is related to scientific credibility in the sense that the exactness of the numbers in quantitative scenarios may be mistaken as a guarantee for their scientific soundness and vice versa for qualitative approaches.

So, there are convincing arguments on both sides of the question of qualitative versus quantitative approaches. In this context, it is important to note that the more recent scenario exercises and literature stress the importance of the integration of quantitative and qualitative data and techniques in order to develop more complete representations. As an example, the 'storyline and simulation' approach of the MEA-scenarios can be mentioned (see case studies). It is based on an iterative combination of quantitative and qualitative approaches. Five different models were used, and each model was run separately for each storyline with input values based on the story lines. The results of the model runs were then compared with the narratives to verify the assumptions, to check the story lines for internal consistency, and to add quantitative information. The final product for each scenario was a qualitative narrative that contained quantitative information.

3.6.2. On participatory approaches and the value-added of scenarios

The use of *participative* tools, the level of participation and the different kind of actors involved are an important characteristic of scenarios. A typical feature of contemporary scenario development is the involvement of decision-makers and important stakeholders in addition to the traditional group composed of scientists and experts. The involvement of stakeholders is done at different degrees (from single interview to workshops) with the aim to increase the quality of scientific inputs into the scenario building process. As has been discussed in the particular context of the scenario axes technique (see above), this trend addresses the objectives of 'post-normal' science to formulate a more socially oriented process of knowledge construction (e.g. Funtowicz and Ravetz, 1993). Indeed, scenarios have a potentially important role to play with regard to the increasing demand for more public and stakeholder involvement in the scientific activities. This demand is driven by a complex mix of factors, including increased public distrust of expert-driven decision making, growing awareness of a diversity of opinions in the scientific community, and increased sophistication of NGO, private sector and public involvement in regulatory and other decision-making fora. These evolving dimensions of the

policy–science interface suggest that participatory forms of scenario analysis could be particularly effective in addressing the strategic and normative elements of sustainability questions by incorporating values and preferences into the scenario analysis process itself. In parallel, scenario exercises are more and more presented as characterised by a focus on the *process and/or the output* of the exercise. The double question here is whether one aspect is more important in terms of impacts then the other, and whether it is necessary to make a trade-off between the two. In this context we have already referred to the recent trend in scenario studies of combining a broad exploratory process to raise awareness, stimulate creativity, and empower the users of scenarios before engaging, on the basis of a broad range of the resulting exploratory scenarios, a second phase of identifying the relevant and desired goal –or sets of goals- and then building the paths to reach them. In this way, by supporting successively a social learning and a goal-oriented project, the scenario exercise is characterised by a focus on both process and product.

3.6.3. On intuitive and structured approaches

From the methodological discussion, it may have become clear that scenario development can also be characterized by a varying degree of adhering to an *intuitive versus structured approach*. The 'emblematic events' approach described above can be seen as a rather intuitive approach whereas the scenario axes method is (rather) structured. It could be argued that a structured approach may contain a higher guarantee that a final product in the form of one (or more) scenarios will be delivered but may reduce creativity, although this is not necessarily the case. The use of systems thinking, e.g. in the form of a conceptual model, has been suggested as a structured way to explore the logics and check the consistency and coherence of a scenario. This is contrasted by the fact that a lot of coherent and consistent scenarios have been developed without a conceptual model as a basis. It may at this point be illustrative to look at the analogy with two different kinds of novelist: the intuitive and the structured writer. Whereas the structured kind of writer will start by getting the outline of his novel down on paper, the intuitive writer sits down and starts writing the novel, perhaps having some implicit outline in the back of his head. Reality shows that both types have produced literature of the highest quality.

4. Scenario content (what?-typology)[5]

In terms of content, scenarios can be analysed along different dimensions that allow situating an exercise in the diversity of exercises. After a broad overview of content-related issues, which are summarized in Table 1, a few specific themes will be discussed in more detail by analysing them with respect to the three basic modes of futures thinking.

Obviously, scenarios can be classified according to their *main focus*. In that respect, we can distinguish between: *global & integrated* scenarios which aim to address a whole range of issues at the Earth/global system level (e.g. , the MEA, the Great Transition scenario), *area-based* scenarios addressing the evolution(s) of a specific geographic level (Liège 2020), *issue-based* scenarios focusing on specific societal issues or sectors (the IPCC scenarios, the biodiversity focus ALARM scenarios, DP21), *institution-based* scenarios which address the spheres of interest of an organization, of a sector (e.g. the OECD scenarios, the Shell scenarios, etc.). Of course, these distinctions are overlapping; one scenario or scenario exercise can be characterized by more than one focus, e.g. being at the same time area- and issue-based, at the same time issue- and institution-based (World Water Vision[6] or the Greenpeace energy scenarios). Moreover, a scenario can also be area-based and integrated (e.g. Nord – Pas de Calais 2020, VISIONS[7], etc.).

A related important parameter to classify scenarios is the *spatial scale*. Scenarios can be developed for different spatial levels: global, supranational, national, sub-national, regional and local. But more and more, scenario developers stress the need of vertical integration through different spatial scales (like in the VISIONS project at the European level, or the World Water Vision).

Scenarios can easily be classified according to their *time scale*. This characteristic distinguishes between a *long-term* and a *short-term* perspective, sometimes completed by a *medium-term* perspective. Whether a study takes a short or long-term view significantly depends on the context of the study. 10 year may well be a long-term perspective in a business scenario focussing on the development of new product line, whereas the same period could mean a short-term in e.g. a mobility scenario. However, as a general rule a long-term scale for a scenario is 25 years or more whereas a short-term scale is 0–5 years.

The *temporal nature* of the scenarios itself can be a classification parameter. Some experts[8] distinguish between a diachronic description of the evolution of the studied system across time, a

[5] This section is based on a review of scenario literature and mainly on van Notten et al. (2003)
[6] The World Water Vision, is a scenario exercise clearly focused on the water issues, but which have been developed through the pre-existing World Water Council.
[7] The VISIONS scenarios developed by the ICIS Dutch team are meant to be vertically (between spatial scales) and horizontally (between issues) integrated visions of the long term future of Europe in the framework of sustainable development.
[8] E.g. Mermet

chain scenario (or *development* scenario), and a synchronic description of a specific state of the system at one moment in time, a *snapshot scenario*. As has already been mentioned, some scenario experts do not classify snapshots as scenarios at all. Another, less important, temporal characteristic of scenarios, is their *vantage point*, i.e. the point in time when the story starts (it can be in the present, the past or the future).

Linked to the 'how?-typology', scenarios are mainly characterized by the selected *variables* used to structure and develop the narrative: their type (*qualitative*/*quantitative*), their numbers, the nature of the variables (actors, sectors, factors, etc.). As a scenario is developed on the basis of a selection of driving forces and/or trends, an interesting point to analyse is which variables have been chosen, in which direction they evolve and also try to understand why the authors chose this direction. For example, if in a scenario the technology factor plays an important positive role, we can question the authors beliefs and values in the "power of human volition" or in "the power of science to solve problems", and look if this kind of assumptions are made explicit or not by the scenario developers, in the construction phase or in an ex-post evaluation of their work. This issue is discussed in more detail in the case studies.

At another level of analysis of the content, we can also differentiate the dynamics inside and between scenarios. Considering the *dynamics within one isolated scenario*, we usually distinguish between trend and peripheral scenarios. Trend or "surprise-free" scenarios are characterized by continuity; they can be generated, for a large part, by the predictive mode of thinking about the future. *Peripheral* or shock scenarios are precisely meant to include surprises, wild cards, unexpected events, i.e. discontinuity. Considering the *level of deviation* between different scenarios of a same scenario exercise, between a range of possible futures, we can distinguish between *alternative* scenarios which differ significantly from one another, and *conventional* scenarios where all are trends scenarios and overlap are possible (can be used to fine-tune an existing strategy). Close to this idea, we can also observe the *diversity of perspectives* in one scenario or scenarios set. If we define "perspective" as supposedly consistent descriptions of how the world functions and how decision-makers should act upon it, it can be interesting to know if one scenario is trying to describe one specific perspective or to integrate different points of view, etc. and if it is done on purpose or not.

Scenario can be distinguished according to the explicit *inclusion (or exclusion) of norms*. This criterion is controversial as far as we think that norms cannot be excluded from one's way of working and thinking. But so far as we limit our considerations to what is explicitly stated, some scenario are meant to be more descriptive and other to be more normative. See below for a more detailed discussion of normativity with respect to the three modes of thinking.

One more characteristic is the *level of integration* of the different dimensions and variables described or developed in a scenario. Nowadays, scenario developers insist on the extent in which components relevant to a subject are incorporated and brought together to form a coherent and logical whole. This

is presented as an important characteristic of scenarios, which, through their narrative, are said to have a higher capacity than other tools, to make apparent the links and interconnections between the different elements of a specified system. This focus on the integrative capacity of scenarios is closely linked to the need for an integrated approach towards sustainable development.

In Table 1, the main features addressed here are summarised. From the multiplicity of issues it may be clear that this "what?-typology" is too detailed to help order the field of scenarios. It can be mainly useful in a stage when somebody is already engaged in a particular process and tries to get an overview of what has already been done. The interest for one or several of these "what?-parameters" will be a function of one's engagement in the field of scenarios (a specific issue, area, or of the objectives pursued, etc.). For example, in the Consentsus project, where the idea is to construct different pathways towards sustainable consumption, the focus may be on the inclusion of norms and diversity of perspectives. Indeed sustainable development is a normative goal, which can be traduced through different world views, and it is important to identify in the studied scenarios how this aspects are included or not, explicitly or not and how, etc (see below on normativity and modes of thinking).

WHAT? TYPOLOGY (SCENARIO CONTENT)	
Scale(s)	global, supranational, national, sub-national, regional and local, vertical integration
Main focus	global & integrated, area-based, issue-based, institution-based, etc.
Time horizon	Short, medium, long term
Temporal nature	Snapshot or chain scenario
Variables	Qualitative/quantitative, etc.
Dynamics (within one scenario)	Trend or peripheral
Level of deviation (between the scenarios of the exercise)	Alternative (high)/conventional (low)
Diversity of perspectives (in one scenario)	Yes or no
Inclusion of norms?	Yes or no/ implicit vs explicit
Level of integration	High or low

Table 1 Main dimensions related to scenario content

Besides these qualitative issues characterising specific scenarios, two more substance-related aspects are worth discussing based on reviewing several case studies (see case studies). One is related to the assumptions underneath the scenarios (the driving forces), the other is related to the scenario plots.

What forces are shaping scenarios?

Scenarios are a way of understanding the dynamics shaping the future. Driving forces at work in scenarios can be categorised in many different ways which pertain to a different way/level of looking at the way society is shaped and possibilities for change.

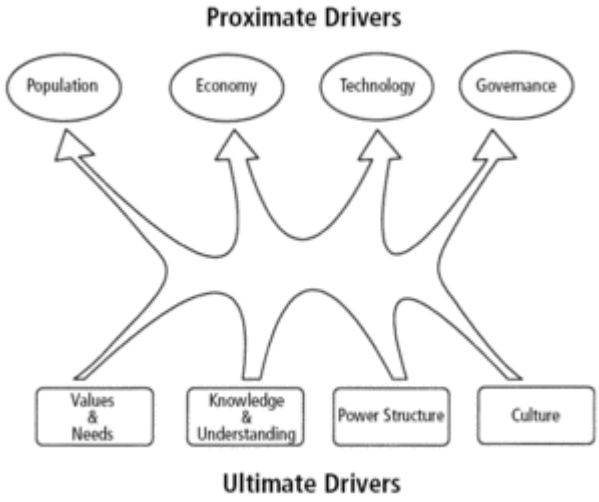
In a rather straightforward approach, driving forces can be related to five major categories: social, economic, political, technological and environmental issues. These are the same five categories of possible driving forces as proposed by GBN in their methodological explanation. Under the description of the methodological step "Brainstorming a list of key factors" they suggest to consider these five general categories of forces and trends. And indeed, looking at the variables/driving forces identified in the case studies, it is always possible to allot them to one of these categories, or a combination of them. Indeed, categories are only handles and real issues will entail a bit of all five forces. It will also depend on the focal issue at stake, which categories will be prominent. Also, it can be expected that backcasting approaches will focus on the political drivers as the question 'how can a desired future be realised' is at stake here. E.g. in the Possum project (see case studies) different policy paths were constructed based on different policy packages, i.e. combinations of policy measures that are likely to work well together, which create synergies. This does not imply that backcasting is exclusively used in a political context; a company may well use a backcasting method to identify possible paths towards e.g. increased sales figures.

If we look for instance at the key uncertainties of the DP21 scenarios; we can easily relate them to one or more of the categories mentioned above: Non-trade concerns in WTO negotiations (political/economical), prosperity and buying power (economical), regulatory framework (political), role of new-EU countries (political/economical), position distribution sector (economical), implementation Flemish manure policy (political), consumer confidence (social). As the focal issue of this exercise is an economic sector, it may be no surprise that mainly economic and political driving forces were identified.

It is interesting to no note that the Toolsust researchers present another categorisation. They have observed a posteriori that the different dimensions used as axes for the scenarios in the different cities can be synthesised in four general 'regimes' that govern society and shape our visions of the future: 'the use of space', 'the values of everyday life', 'how society is organised', 'the role of technology'. Scenario drivers or uncertainties can be characterised by more than one regime and some are mainly based on one of those regimes. This level of analysis/categorisation seems already more focussed on driving forces that have the potential to provoke fundamental change in society.

The Great Transition project further identifies a (more) 'fundamental' level of analysis in which they distinguish between categories of 'ultimate drivers' (See Figure below). They argue that whereas mainstream development policy focuses on the proximate drivers (as is the case in their scenario *"Conventional Worlds"* where strategies operate on the direct levers of change that can influence economic patterns, technology, demographics and institutions), fundamental change in society can only be attained by going deeper to the root causes that shape society and the human experience (as is explored in their *"Great transition scenario")*. These ultimate drivers include values, understanding,

power and culture. Proximate drivers are responsive to short-term intervention. The more stable ultimate drivers are subject to gradual cultural and political processes. They define the boundaries for change and the future



When being involved in a scenario construction process, it may be essential that these different levels of analysing and categorising driving forces are brought to the attention in the developing phase. As one has to think about possible scenario variables, it can be important to think within these different levels as these pertain to different ways/levels of shaping society. In particular, when thinking about scenarios focussed on the theme of sustainable consumption it might be interesting to think of consumption in terms of the different levels of analysis identified above: from a more policy-reform oriented view to a perspective of fundamental societal change. In fact, this is what has been done in WP1.

What kind of worlds are portrayed in scenarios?

As Ogilvy and Schwartz (2004) point out, each scenario plot or logic should be different, yet relevant to the focal issue. Nonetheless, there seem to be a few archetypal scenario plots that seem to arise over and over. Winners and Losers is a familiar plot based on the concept of a zero-sum game: the strong survive and the weak get weaker; Challenge and Response is a typical adventure plot story of overcoming obstacles and being transformed in this process; Evolutionary Change, finally, is a plot governed by slow change in growth or decline in all systems. These plots are derived from observing the twists and turns of our economic and politicial systems, the rise and fall of technologies, and pendulum swings in social perceptions (Ogilvy and Schwartz, 2004). A similar conclusion is also drawn by Raskin et al. (2005) who states that beneath the diversity, scenarios are rooted in a common set of archetypal visions of the future – worlds that evolve gradually, shaped by dominant driving forces; worlds that are influenced by a strong policy push for sustainability goals; worlds that succumb to fragmentation, environmental collapse and institutional failure; and worlds where new human values and forms of development emerge. Also Gallopin et al. (1997) maintain a similar typology of scenario

plots by referring to three fundamental streams of social visions reflecting fundamentally different mindsets about how the world works: the evolutionary, the catastrophic and the transformational.

Ogilvy and Schwartz	**Raskin**	**Gallopin**	**DP21**	**MEA**	**Costanza**	**Possum**	**GSG**
Winners and Losers	***Worlds that succumb to fragmentation, environmental collapse and institutional failure***	***Catastrophic***	The Race	Order from Strength	Mad Max		barbarization
Evolutionary Change	***Worlds that evolve gradually***	***Evolutionary***	Forum Europaneum	Global orchestration	Big Government		
Challenge and Response	***Worlds that are influenced by a strong policy push***	***Transformational***	Global Bazar	Adapting Mosaic Technogarden	Ecotopia Star Trek	All 3 images	Policy reform
	Worlds where new human values and forms of development emerge						Great transiton

In the Table above, the different scenarios addressed in the case studies are listed according to the plot category they adhere. As could be expected for a backcasting exercise such as Possum, all images fall under the Challenge and Response category.

In conclusion, a few specific content-issues are discussed in relation to the three basic modes of futures thinking as is schematically depicted in Table 2.

	Predictive	**Explorative**	**Normative**
Time scale	Short	Long	Long
Variables	Desk top (collecting)	+Imagination (generating)	+Imagination (generating)
Normativity	Implicit	Implicit + explicit	Implicit + explicit + ex-ante
Dynamics	Surprise free	Real surprises?	Trend break?

Table 2 Content issues in relation to the basis modes of futures thinking

Regarding the ***time scale***, it is often reasonable to assume that present trends or dynamics will prevail for some time, even though in the longer perspective there is always the possibility of structural change of the system of interest. Hence, the hypothesis is that the predictive mode of thinking applies in the short to medium term whereas the explorative and normative mode in the long term. In some areas, however, development seems to alternate between long periods of stability and relatively short periods of rapid change and instability (often related to shifts in technological regimes). During these 'chaotic' phases, new patterns evolve and eventually dominate for some time, although these patterns are difficult to discern early on. A consequence of this line of reasoning is that predictive models may sometimes be inadequate even in the short term, because the system studied is currently in a stage of structural change, but its observed behavior is difficult to interpret (Dreborg, 2004).

On the issue of the ***variables*** in relation to the basic modes of thinking, there is an interesting point to say on creativity, imagination and the way variables come into being in a scenario construction process. Within the predictive mode of thinking, the trends and issues to be dealt with are collected mainly via desk-top research. When there is shortage of data or when the complexity of the problem at stake is too big, a participatory approach such as the Delphi method can be suitable but also here, it is merely a process of collecting and selecting the variables that need to be 'predicted'. In the explorative mode, the selection of the variables is very important due to the high degree of openness to several possible events and different developments. Besides collecting information on existing trends, a certain degree of imagination and creativity is needed in envisioning possible crucial events. The changes required to reach desirable images of the future under the normative mode of thinking are profound. Imagination and creativity will therefore be crucial in envisioning the necessary steps towards a normative vision.

According to Swart et al. (2004), ***normativity*** enters a scenario in two ways. First, explicitly, the scenario plots make assumptions about future behaviours and worldviews of scenario actors, involving assumptions on norms and values as well as socio-political and institutional options. Second, implicitly, the worldviews of the people creating the scenarios shape the way the story is told and what policy lessons are drawn. With respect to the three modes of thinking, it is clear that the explicit way, absent in the predictive mode, is most prominent in the normative mode. Here, a normative target is explicitated ex-ante and storylines are 'shaped' to lead towards this target. It is this specific aspect which distinguishes the normative mode from the explorative mode where normative elements do enter the storylines but they are not constituted by an ex-ante high level target; they are 'explored'. Regarding the implicit way normative elements enter scenarios, it may be clear that these will be present in any human-made scenarios whatever mode of thinking they belong to.
In this context, it is remarkable to observe that scenarios are promoted as a means to address the inherently normative decisions of sustainability that goes beyond the boundaries of the traditional

scientific enterprise. In the context of 'sustainability science' (Swart et al., 2004), it is argued that the systemic character of sustainability problems demands a holistic perspective that unifies across sectors, problems, methods, disciplines, spatial scales and time. Furthermore, the strict distinction between the realm of the normative and the objective, the ''ought'' and the ''is'', is not useful when the system under scrutiny entrains human values and choices as irreducible and critically important system constituents and drivers of change.

Concerning the ***dynamics*** within one scenario, it is clear that the predictive mode of thinking gives rise to trend or surprise-free scenarios. It is indeed impossible to predict or model surprises or trend breaks. Peripheral scenarios can be related to both the explorative and the normative mode of thinking as these are supposed to reflect uncertainties, incorporate surprise and account for volition and the possibility for 'seeds of change' and 'trend breaks'. At this point, a critical and possibly crucial question regarding the possibility of human beings to imagine real surprises and trend breaks can be posed, i.e. Is it really possible for human beings to get beyond extrapolation and "more of the same"? Indeed, a lot of scenarios which pretend to deal with real surprises and trend breaks are mere extrapolations where present innovations such as bioengineering or hydrogen technology are made absolute (De Rijk, 1996). In the scenario literature, however, the analysis is made saying that our present society, as a stable science-technology-society configuration is an emergent phenomenon; the result of a complex evolutionary process which transcends the limits between science and society. It is only ex-post that the evolution of emergent phenomena can be interpreted. Both the natural order (scientific knowledge and technology as a result of science) and the social order (society as a result of politics) are the stabilised result of the same evolutionary process. Is it not reasonable to state that the interwoven ways in which Internet has shaped everyday life of people and has itself been shaped by people's beliefs and desires could not be imagined ex-ante? Then, where originates the idea of scenarios as a new tool which can make sense of these complex processes?

5. Preliminary conclusions

Perhaps, one of the major conclusions to be drawn from this survey study of the scenario field is that there are no clear-cut conclusions to be presented to somebody who wants to embark on a scenario construction process. There is indeed no cut-and-dried recipe to be given on what methodology to be followed to attain a certain goal. This is due to what we have called the 'fuzziness' of the scenario field. Although we have tried to order this broad and fuzzy field from three perspectives (the why? what? and how? typologies), it has often been stressed that such a categorisation is a mainly a theoretical perspective which is challenged by the complex reality of the scenario practice. Indeed, modes of thinking, which are in a way fundamental, as well as methodologies, originally attributable to a mode of thinking, are combined in combined in differing degrees to form a 'hybrid'; the particular choice for the latter informed by the particular needs of the scenario users to be met. These typologies set a frame of reference, they can form the basis of a conscious choice for a particular approach but they are not a prescriptive tool.

So, in a way, the fuzziness and the related existence of hybrid senarios, can be regarded as an opportunity rather than a weakness. Rather than following a cut-and-dried recipe we can take the 'ingredients' (approach, technique, content elements, …) we like and mix these to make our own hybrid that suits our needs. E.g. a hybrid scenario (such as Possum) mixing explorative and normative modes of thinking and related methodologies (such as the axes technique and backcasting, …) may suit our needs as it combines a comprehensive view of the field of driving forces and influential pervasive phenomena in society together with the strategic options available for reaching a certain target. It may be clear that a clear view on the intended use and relevance of a scenario will further determine the needs that have to be fulfilled by the approach eventually opted for (see Work Package 3).

In assessing our needs with respect to the tools that are available, there are however a few essential considerations to be taken into account when embarking on a scenario construction process. Recently, a whole discourse has developed which sets the context for the scenario approach holding the prospect of great potential for sustainability issues. In such theoretical considerations, rather contrasting potential benefits are said to be attainable from working with scenarios while looking at real scenario cases a kind of trade-off between them seems to be at play. Apparently, certain pitfalls are present when making scenarios. By presenting them here in terms of tensions, we want to make these pitfalls clear, indicating at the same time some major challenges for future scenario work.

5.1. Scientific soundness versus creativity and imagination

The tension between scientific soundness and creativity and imagination has been addressed at several points throughout this paper: The discussion on strong plotlines versus strong storylines as well as on participatory versus expert driven, structured versus intuitive and quantitative versus

qualitative approaches can all be related to this basic tension. It seems that the classical norm of scientific soundness as being equivalent to objective, quantitative data obtained in a structured approach is still in force in the scenario field. Indeed, a lot of scenarios can be found that show a tendency towards this classical idea of 'scientific soundness'. Big scenario exercises such as the Millenium Ecosystem Assessment adopt structured approaches with a lot of attention to modelling for delivering quantitative data but seem to fail in bringing a challenging and compelling scenario. This has e.g. been discussed in the context of storytelling where a qualification of bad scenarios was proposed based on scenarios that either have poor storylines and strong plotlines or vice versa. An undue one-sided focus on either scientific soundness (resulting in strong storylines but poor plotlines) or creativity and imagination (resulting in strong plotlines but poor storylines) seems to be the fundamental cause for this kind of 'failure'. Similar reasoning could be developed on participatory versus expert driven, structured versus intuitive and quantitative versus qualitative approaches. It may be clear that a major challenge for scenario developers is situated in overcoming this tension.

5.2. Consensus scenarios versus scenario ownership

A typical feature of contemporary scenario development processes is the involvement of decision-makers and important stakeholders in addition to the traditional group composed of scientists and experts. The involvement of different stakeholders and experts is done at different degrees (from singe interviews to workshops) but also with different aims. On the one hand, participatory approaches are promoted as a means to increase the quality of scientific inputs by incorporating expert knowledge and judgement of relevant stakeholders into the scenario building process. On the other hand, participatory approaches are deployed to ensure the acceptability and relevance of the results or –to put it even stronger- to create 'ownership'. In particular, when the scenario-product is taken a step further in a change process (e.g. a transition management exercise), it seems important that the participants involved take ownership of the process and the results Related to this aspect of ownership is another potential pitfall in scenario development. It has e.g. been observed that broad participative constellations tend to end up with a 'consensus' scenario: a scenario all participants will settle for but which none of them regards as being 'his' or 'her' scenario. This limits the possibilities for using the scenarios in a consecutive change process. A limited participative process, on the other hand, may well succeed in elaborating a scenario all participants 'own', but may not be useful because of the lack of stakeholder involvement, i.e. the persons who could initiate a process of change were not involved. How to engage people, having differing worldviews and normative frameworks and often contrasting concerns in a participatory process to develop a scenario they all 'own' is clearly another major challenge. On a more practical level, it should be realized that the composition of the scenario team is of major importance. What kind of people are needed and what kind of people should be avoided in order to arrive at a 'useful' scenario. This not only relates to their scientific or other expertise but also to their 'human' capacities: openness to other worldviews, capacity for creative thinking,…

5.3. Process versus product focus

On a more overarching level, scenarios are often presented as characterised by a focus on the process and/or the output of the exercise. The double question here is whether one aspect is more important in terms of impacts then the other, and whether it is necessary to make a trade-off? Post-normal science offers an interesting perspective from which this challenge could be tackled as it provides us with a framework which focuses on the process of knowledge construction as a major characteristic for the quality of the product of this process. Scenarios, viewed as the social outcome of a systematic process of weighing different arguments, have a potentially important role to play with regard to the increasing demand for more public and stakeholder involvement in the scientific activities. These evolving dimensions of the policy–science interface suggest that participatory forms of scenario analysis could be particularly effective in addressing the strategic and normative elements of sustainability questions by incorporating values and preferences into the scenario analysis process itself. In this way, the quality of the scenario construction process, although not sufficient, is a prerequisite for a high quality scenario.

One final consideration, although of a practical nature, may well turn out to be of overriding importance. A scenario process needs two essential ingredients: people and time. This implies that time and budget will constitute important boundary conditions for the elaboration of such a process.

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