METHODOLOGICAL PANORAMA "MAPPING OF RESEARCH RELATED WATER FORESIGHTS"

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SCIENCE AND SOCIETY INTERACTING: THE NECESSITY OF "FORESIGHTS" FOR RESEARCH POLICIES

In the general field of research and innovation policies, it is commonly acknowledged that "*foresight*" is a necessity in order to plan research and innovation efforts corresponding to future needs of society. The very first reason for looking at future research needs is that the time frame between the initiation of research and the delivery of its outputs expands over years : it is therefore necessary to imagine how society will look like in some 5, 10 or 30 years because it is this future society who will be able to use what research and innovation will have produced.

A second reason to base research and innovation policies on the identification of future needs of society is that it enables a dialogue between science and society that leads to a better mutual understanding between researchers and their partners in society, and also to a better commitment of scientists, technologists and other stakeholders to the research and innovation policy priorities that will have been decided based on such a "*foresight*" process (Ben Martin, 1995; Rémi Barré, 2000 - we will describe below the types of approaches, procedures and techniques that can be gathered under the overall wording "foresight").

The commitment of the whole society is needed because of two types of risks:

- the risk that society remains indifferent to reaching research and innovation goals, and that not enough partners get involved in the research and innovation process,
- the risk that some stakeholders might strongly question the technological choices that would have been made without enough participation of the whole society (the case of GMO is an example of such a crisis).

Therefore, engaging in a process of common identification of research priorities with the whole society is seen as a way to increase the "social robustness" of science and technology.

WATER RESEARCH AND POLICIES: ESSENTIALLY FUTURE ORIENTED ACTIVITIES

Concerning research for water policies, as for environmental policies in general, looking ahead in the future seems necessary for the reasons explained in the former paragraph, but also for some more specific ones.

First of all, water policies might often be only designed in reaction to already patent evolutions of the state of water systems, in order to cure already occurring damages or to remedy to environmental problems when they are already in place. But water policies also intend to be able to prevent damages

to occur, and to be more pre-active than just re-active. They need to be able to anticipate future evolutions.

Further than prevention, the precautionary principle is an even stronger necessity to look into the future at plausible evolutions and events, even if there is a lot of uncertainty. Based on the mere possibility of some unwanted future evolution of the state of waters, it is recommended at the same time to take temporary measures of action and to focus research on these evolutions, in order to reduce uncertainty. Exploring the future in search of possible changes is therefore imperative in the framework of the precautionary approach :

- in order for precautionary action and measures to be the most legitimate possible, which means that the possibility of an unwanted future change in the state of the environment should have some evidence base, even if there is a lot of uncertainty,
- and in order to build the necessary research strategy that will help reduce uncertainty.

This precautionary approach is quite different from risk management, because the array of possible future states of the world are not known in the present. A risk analysis and management model would recommend to build an event tree to encompass and take into account all possible futures in order to choose the optimal strategy : but uncertainties are at the heart of many of the evolutions of the water systems we consider, and the "event tree" is actually an "event jungle", where it is impossible to have a complete overview of future evolutions. Looking at the future therefore means trying to develop "maps" for navigation in this jungle, and identifying possible pathways. These possible pathways are useful first for research strategies, that will help understanding the evolutions that are occurring, but also for policy development when action is already necessary.

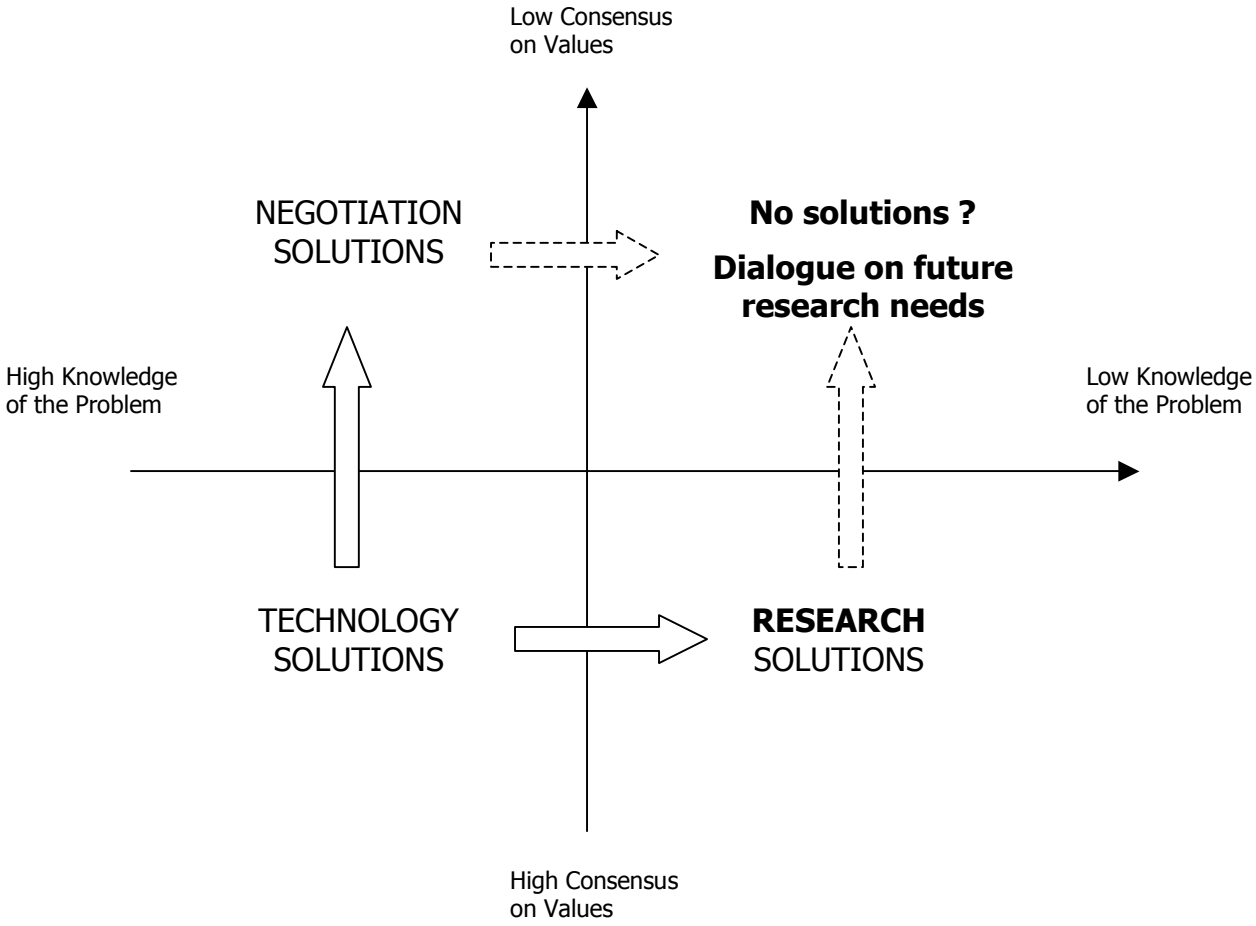
On top of that, the objective of sustainability particularly necessitates to look at future evolutions, because it is intrinsically a dynamic concept, and to think to the future at a time scale longer than just one generation. It is therefore not a surprise that more and more environmental policies (the Water framework directive, the Marine Strategy, …) prescribe to set long term future environmental objectives (good ecological status of waters by 2015 or 2021, Environmental quality goals for 2021 in Sweden…). Sustainability requests not only pre-activity (to anticipate future evolutions in order to be able to react in time) but also pro-activity, which means that we want to anticipate possible futures in order to be able to change them and to propose an alternative desired future. Therefore, research strategies aiming at supporting water policies need to be even more pro-active, helping us to shape innovative desirable futures.

RESEARCH FOR WATER POLICIES: WHAT FUTURE ISSUES DO WE NEED TO LOOK AT?

Water policies are a specific case of environmental policies. A variety of elements concerning the future are important for the design of today's environmental policies: future evolutions of human activities and of society, future technological developments, future evolutions of the ecosystems… New

risks, new opportunities, new ideas… For the implementation of the Water Framework Directive, explorations of these various elements have already begun in various districts.

But among these variety of possible issues raised by investigating the future, where lies the specific field relevant for research strategies? A first typology can be proposed to specify the role of research.



A typology of situations : where is the role of research ? of foresight ?

(source : E.Fellenius, presentation at the SKEP Workshop on Foresights, Paris, June 2006)

Some issues or situations are characterised by a high level of knowledge and a high level of consensus on values : for these issues, what is needed is implementing technological solutions ; some other issues are characterised by a high level of knowledge but a low level of consensus on values : for these issues, what is needed is a negotiation process. But for issues where the level of knowledge is low, research has to be implemented, and if the consensus on values is also low, then it is useful to prepare research priorities by a dialogue on future research needs.

Identifying long term strategic issues for water policies therefore will lead to different outputs :

- on some issues, the result will be to fund new research,
- on some other (or the same) issues, the answer would be to develop new policies,
- and on some specific issues with high uncertainty and high controversy, the first step will be to foster dialogue between science and society.

A COMMON GOAL FOR FORESIGHTS…

Even if it seems clear that looking into the future is a necessity, it appears that a variety of reasons to do so might lead to a diversity of approaches. Nevertheless, a twofold objective is shared :

- to be proactive in research and in policy (plan research efforts in advance, support policies with strategic advice),
- and to build dialogue with society.

The first one is a cognitive objective : the intention is to be able to leave back outdated assumptions, to challenge routines and dominant cognitive models, in order to set relevant research priorities (and to support relevant action). The second one concerns partnerships : the intention is to "wire-up" a stakeholder community (the partners of the "innovation system", research and society), being able to harvest a variety of perspectives, to disseminate new insights, and to co-design collective targets (first of all research priorities, but also in some cases policy targets).

Therefore, the following description seems correct for the diversity of approaches we are interested in : they all intend **to examine systematically and collectively what could be the potential threats, opportunities and likely future developments which are at the margins of current thinking and planning**.

… ALWAYS EMBEDDED IN SPECIFIC RESEARCH AND POLICY PROCESSES

What makes that the approaches to implement foresights may differ from one institution to another is that they are dependent on the specific research planning and policy making processes they intend to impact on.

For some institution, it might appear that no specific time or resources can be devoted to looking into the future as a separate activity, but that pro-activity and thinking of possible future evolutions is a major criteria for the permanent critical reflection and adjustment process on research strategy and policies,

a criteria that the research planner has to keep in mind every day. This of course enables a close link of future thinking to everyday work and to decision making, but at the same time it is at risk to be too myopic about the future, if no specific moment is devoted to exploring future evolutions.

For some other institution, "foresight" can stand as a formal part of activity, with specific means, persons and time devoted to it, and with specific evaluation of its results. There, a thorough exploration of possible future changes might be ensured, because it is the very goal of the activity, but the link to every day work and decision making remains a challenge.

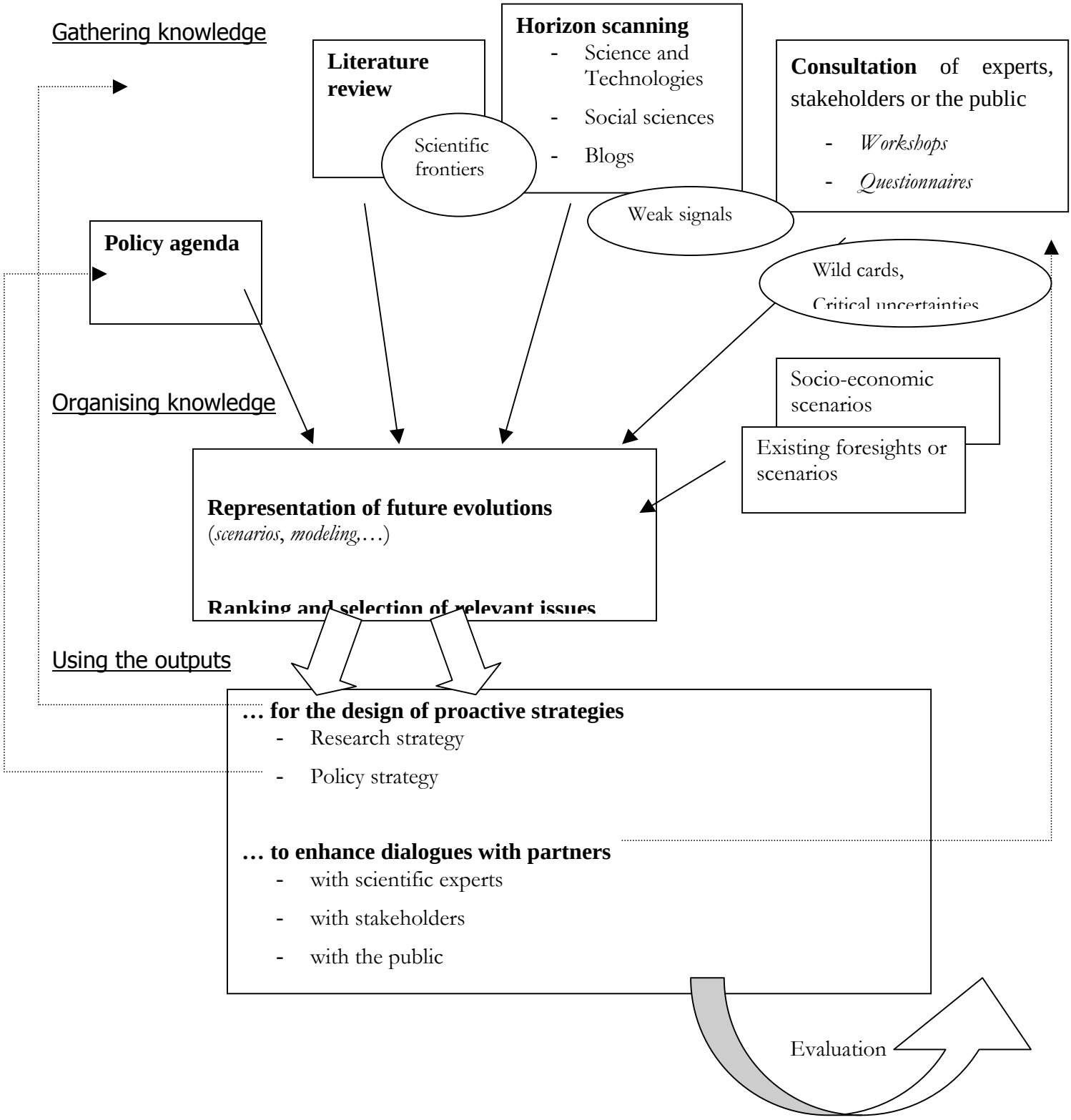
And in various other institutions, a particular future oriented activity is organised at various points in the processes of research planning and policy making : from rather non formalised discussions between researchers and the research programme board on upcoming issues when new priorities within a programme have to be set, to structured "foresight" workshops before deciding to create a new research programme…

This is why this report does not propose a best practice perspective, but rather a common framework to be able to think about the variety of possible approaches or techniques that might be useful, in every specific situation, to introduce pro-activity and future thinking where it seems necessary.

The following page proposes a first synthesis of such a framework, using a general 3 steps approach : gathering knowledge, organising knowledge, and using the outputs. Each step will be more explicitly dealt with in a further section of the report.

Of course, the perspective used in this representation is pragmatic and project oriented, because it is supposed to help a project manager interested in launching a foresight exercise. It has to be stated that foresighting is a much more iterative and ongoing process, where many retroactions do occur, and where results of one phase do interact with the exploration of the future in the next phase.

AN OVERALL FRAMEWORK FOR POSSIBLE APPROACHES OF FORESIGHT AND HORIZON SCANNING



EXPLORATION : HOW TO GATHER KNOWLEDGE

LOOKING FOR INFORMATION IN A VARIETY OF DIRECTIONS

The range of information and knowledge that we intend to look at is very wide : whatever is on the horizon and may come "over the horizon", emerging trends, weak signals, early warnings, advanced indicators of future changes… might be watched for in a variety of directions, and it is commonly admitted that a condition for a good foresight is that a diversity of perspectives has been gathered.

Concerning research for water policies, a major source of information is of course science : publications, conference proceedings, field reports, peer reports, are all sources where information on emerging issues might be found.

Identifying new science or what is at the scientific frontier is useful because scientists themselves exert watch on new issues to be put on the agenda (the best example is Climate change and the greenhouse effect), but exploring scientific productions is also important in order to be able to trace back the information on some emerging issue to evidence based scientific work.

It may also be useful to look at the whole trajectory from science to technology development (patent applications, venture capital movements, company start ups…).

But it is also important to try to gather information from other directions : evolutions of the society, of behaviours, institutions, might be important emerging trends that social scientists have observed. It is therefore important not to forget social sciences in the process of looking at scientific production.

Foresight practitioners and methodologists do insist on the fact that issues that will be important in the future might also emerge from less conventional sources of information : for various environmental cases, it is well known that some important early warnings came from whistle blowers or from lay knowledge (stakeholders rather than experts, and even the common public)… This type of information and knowledge might be important to take into account, because it includes tacit experiences and empirical evidences. It might therefore be very useful to be able to look at information contained on blogs, press reports, activists or NGOs reports, or to consult a variety of stakeholders : experts, politicians, decision makers, stakeholders, companies, national or local authorities, NGOs, citizens…

The policy agenda for the future is also a very important resource to look at, because long term policy goals can have a strong structuring impact on research priorities.

It is also very important to be aware of the important amount of already existing foresights that could be related to the theme studied. Even if each foresight had been designed for its specific context and its specific objectives, it is very useful to build on existing foresight reports in order to avoid reconstructing the same results.

A VARIETY OF POSSIBLE TECHNIQUES

Techniques to gather this knowledge might be quite elaborated. A literature review might be the most common way of gathering such knowledge, but the approach can be much more systematic.

The most interesting example is the way the Horizon scanning Unit at the Environment Agency for England and Wales has organised a "horizon scanning system" that systematises with a regular frequency the reviewing and registering of relevant information, based on a wide range of information sources (existing visions or foresights for research, scientific publications and proceedings, technology development markers, blogs, press reports, activist reports, analysts reports,…), particularly the ones accessible on the internet. Specific information treatment tools (like semantic analysis) might be very helpful to scan the variety of information available on the internet.

Information can also be gathered thanks to consultation techniques, either during the consultation/creativity part of workshops or using specific questionnaires. Individual questionnaires might be sent to a variety of experts or stakeholders to ask them about changes they see as important in the future. Among these questionnaires, the Delphi technique is a well known expert consultation technique where two rounds of questionnaires intend to make experts opinions converge.

When workshops are organised, a first part of the workshop is aimed at brainstorming on possible future evolutions and changes, which is the part devolved to information gathering. They might be experts workshops or stakeholders workshops, but it is often preferred to use mixed workshops that enable to cross perspectives among participants. In some other cases, thematic or sectoral workshops are organised in order to have people with the same background elaborate more in details possible changes or issues for the future on their specific themes. Here again, some specific creativity techniques might be used to foster individual and collective creativity.

In this report, we do not intend to get into too much detail concerning specific techniques (Semantic analysis, Delphi, creativity techniques…), as they are reported in other specific reports.

This first step in the description of possible approaches brings us at the moment where we are overwhelmed with potentially interesting information on future issues and evolutions. The second step in the approaches is to organise this information and knowledge and to propose a selection of relevant issues.

PROCESSING : HOW TO ORGANISE KNOWLEDGE AND REPRESENT FUTURE EVOLUTIONS

Once the exploration phase has led to gather a large amount of potentially interesting themes, issues and ideas for the future, the second phase is to process this information in order:

- either to represent some possible future evolutions that are relevant for research planning or policy development,
- or to directly rank this information and propose a selection of relevant information.

SCENARIOS TO REPRESENT POSSIBLE FUTURE EVOLUTIONS

After having scanned a variety of weak signals, scenarios help organising our reflection on them and also enable to scope strong signals (already recognised important trends of evolution for the future, inertia, irreversibilities…).

Scenarios are not just projections of past trends, they intend to represent possible paths of evolution that are relevant for action in the field under study. They might be the answer to various types of questions :

- what are possible evolutions, based on existing trends and existing policies ?

It is here intended to build either one baseline scenario (a good example is the WFD 2015 Baseline scenario, or the EEA Outlook's scenarios), relying mostly on trends analyses and projections, or a series of equally probable scenarios, exploring possible future evolutions by taking into account structural changes and cross effects of one sector on another.

The latter approach, known as "scenario analysis", is often seen as more efficient to track emerging issues, changes or surprises, as it enables to explore different combinations of evolutions in different sectors

To build such scenarios for water research and policies, it is often necessary to have as a basis already existing background scenarios concerning the future of various socio-economic sectors (e.g. scenarios for the CAP after 2013…) and of society (demography, values…), but also international scenarios (like the ones produced for IPCC on Climate Change, or for the Millenium ecosystem assessment) that propose a framework to think about the future of the rest of the world.

These scenarios might be the result of the consultation of stakeholders and experts on following questions : "are current actions and agreements sufficient to improve the state of waters ?". They generally lead to a consequence analysis or an impact analysis, or a distance to target evaluation. They can also lead to the identification of possible changes in evolutions that are worth being put on the agenda.

- where do we (or don't we) want to be in the future, and how can we get there (or can we avoid getting there) ?

In this case, the scenario is generally target-setting, and is built through a "backcasting" approach, trying to identify practicable pathways from today's situation to a desired future one (or dangerous pathways to a feared future situation !).

For such scenarios, it seems very useful that the desired situation in the future at the beginning of the analysis has been discussed collectively by a variety of stakeholders, so that the results of the analysis are useful for collective action.

Using both approaches (exploratory scenarios and backcasting scenarios) can help in identifying two types of emerging issues for water policies :

- in one case, a "task finding" approach can lead from global issues to the identification of action that is needed,
- in the other case, a "path finding" approach can help identifying a local agent or a local case that is experimenting a local solution to a common problem.

The construction of scenarios, whatever the approach chosen, is useful to classify among the variety of available information some variables that are of particular relevance for future action and research :

- what are the main drivers of change, the important factors, with high impact and high probability ?
- what are the critical uncertainties, are there any "wild cards" (unconventional change phenomena, with high impact but low probability) ?

Methodological questions are very numerous concerning scenario building, apart from the already mentioned issue of participation of a variety of stakeholders to the scenario building process.

- Modelling can play an important role in scenarios : modelling exercises should not be restricted to the projection of past trends, as they can be used in interaction with more qualitative scenarios, for instance in the "story and simulation approach" proposed by the EEA (EEA methodological reports series n°5, see le list of references).
- The spatial scale of scenarios is very important, as a too global scale might prevent from identifying local issues, and a too local scale might prevent from taking into account interaction among sectors or countries. It is therefore recommended to think of scenarios at multiple scales, or at least, if scenarios are developed at a national or international scale, to downscale these scenarios on a few local examples. It will also make the scenarios more easy to communicate to stakeholders.
- Communication of scenarios is also a very important methodological question. Scenarios might directly be used as a communication product, in order to foster debate on future issues, or they might be an intermediary product that is then going to be used as an input for a strategic analysis. If scenarios are going to be communicated, it is important to make them understandable and communicable, by all means that seem relevant : maps of the future, drawing of images of the imagined future, little narratives of the story of the scenario…

RANKING AND CLASSIFYING INFORMATION

Potential issues for future environmental research and policies can also be sorted directly, without building specific scenarios. This ranking exercise can be done in association with a variety of partners (decision makers, stakeholders, experts…). The classification exercise can also be done by a professional reviewer : the quality of his/her classification is then particularly linked to the regularity and to his/her experience in the art of sensing what is going to be relevant and important in the future.

Criteria for this ranking or classification depend on the type of output that is expected. They might be among the following criteria :

- relevant for water policies/the institution, or not (scope),
- expected impact important or less important (severity),
- certain or uncertain occurrence in the future (probability),
- distance to realization, novelty, timing ("far out" = conceptually possible but not existent, "new to world" = proven in potential but not in practice, "new to the institution" = already existing in practice but not taken into account for the moment)
- risk (technology risk, environmental threat) or opportunity (monitoring or remediation technologies, for instance)
- …

Once sorted and classified, the information on potential strategic issues in the future is ready to be used in the process of designing a strategy, either for research or for public policies.

STRATEGIC USE OF THE RESULTS FOR RESEARCH STRATEGY DEVELOPMENT

The use made of these products (either scenarios or classified future issues) depends on the particular process they are going to impact. We therefore present here the main common feature of the strategic use made of the issues identified in the first two steps, which is about the involvement of stakeholders. We then present some examples of procedures where future emerging issues have been used for the elaboration of a strategy.

PARTICIPATION AND INVOLVEMENT OF STAKEHOLDERS

In the first step presented ("exploration"), we were only looking at the consultation part of the involvement of stakeholders in the process of identifying long term emerging needs. But at every phase of the process, and particularly at the moment of designing a research (or a policy) strategy based on

the exploration and selection of emerging future issues, the involvement and the participation of a variety of stakeholders is important.

By involving stakeholders, three objectives are intended at :

- to gather knowledge from different sources and to confront different perspectives,
- to make the planning procedure more legitimate or more democratic,
- to engage stakeholders in the planning process so that they will be also committed to the implementation phase.

As was already clear from the general context, involving stakeholders or even the public in a specific planning procedure at a particular moment might only be a pretext for fostering a dialogue between researchers, policy makers, stakeholders and the public.

For that purpose, the main issue is to ensure enough diversity of stakeholders, and to try, when relevant, to involve the public, as it has proven possible to do so. Some guidance documents are being produced by foresight specialists on how to engage citizens in such processes. But there might be a trade off between the openness of the process and the focus of the questions. It is therefore very important to define from the beginning whose concerns and needs we want to address.

There is a still open methodological question concerning future stakeholders and decision makers : if we want to identify issues that will be important for the future, it would be even better to try and involve people who will be concerned in the future. That means of course thinking about involving younger people in the process, or trying to organise a workshop with children, for instance ; but how to keep room for the concerns of future generations ? This might be a permanent concern along the whole process, but no global solution has been proposed yet.

BEING ADAPTED TO THE SPECIFIC RESEARCH PLANNING PROCEDURE THAT WE INTEND TO IMPACT ON

A first very important issue of adaptation is to ensure that the results of the process are accessible on time, and to be synchronised with the timelines of the planning or strategy procedure. It is an important issue to deal with, as the exploration part and the participation procedure might often take a lot of time, and as there is a trade off between systematic exploration of all sources of information and analysing them on time.

Hereafter, five examples might exemplify this issue of timelines, but will also illustrate the diversity of possible strategic uses.

Example 1 – Horizon scanning at the EA

At the EA, horizon scanning results are synthesised in a weekly and a monthly newsletter, but also under two specific kind of products : PEFIs (plausible evidence based future issues) and PEFOs (plausible, evidence based future opportunities).

Once a future issue or future opportunity has been identified and classified as relevant, it might lead to a communication product (PEFI or PEFO) mainly consisting of a narrative that enables to convey to the decision maker that the issue or the opportunity is worth being put on the agenda for the development of public policies. The narrative ensures that the issue is more easily communicated, and the horizon scanning procedure ensures that it is evidence based (as British law requests that public policies are evidence based).

The database of classified horizon scanning results is also useful for *ad hoc* searches on specific questions asked by decision makers on specific themes, and visualisation tools even enable to envision connections from one theme to another.

But the horizon scanning results might also be used in participatory prognostics, where the impact of the future issue or opportunity and the necessity for action is evaluated by a group of stakeholders.

Example 2 – How to translate emerging issues into relevant and strategic research questions : Agora 2020, a Foresight on transportation, housing, spatial planning and environment in France

Agora 2020 was designed as a broad foresight exercises involving citizen consultation, stakeholder participation, in the exploration of possible future changes that would be significant in the themes of transportation, housing, spatial planning and environment.

The strategic analysis procedure to get from the result of the exploration to relevant and strategic research questions was the following :

1) panels and focus groups gathering citizens and stakeholders led to the identification of possible important changes, challenges, expectations or solutions for the future
2) these changes and issues were ranked and clustered in expert and stakeholders thematic workshops, in order to selection only the more important and more relevant ones
3) a state of the art of research on the issues selected was realised, in order to identify the scientific frontier on these themes and to specify the new research questions
4) the new research questions were ranked and clustered in expert workshops in order to selection only the most important ones
5) a strategic SWOT analysis was carried out for French national research institutions in order to see on which research questions action would be most favourable.

Fore more details, see : http://www.efmn.info/kb/efmn-brief27.pdf

Example 3 – Research council of Norway : various scales where strategy matters…

For the Research council Norway, at the scale of one existing research programme, programme evaluation and planning of new activities are made by a programme board or a programme planning committee, involving researchers and policy makers. It is within these groups that a non formalised reflection on emerging future issues can take place, during the planning process. The fact that researchers are mixed with policy makers can lead to crossing perspectives that enable to look at emerging future issues that would be of strategic importance.

At a broader scale, before deciding to create a specific programme, structured foresight workshops (mixing researchers and stakeholders, and elaborating open future scenarios) have been organised for some research programmes within priority topical areas, in order to broaden the scope of research strategy development.

Research Strategies at RCN are instituted in order to define and ensure the implementation of research priorities across programmes (e.g. the Northern Areas Research Strategy).

At these three points and levels in the general planning processes, future issues and opportunities might be useful, in a formalised or less formalised way, as one input into the strategic reflection.

Example 4 – "Agriculture and environment : 4 scenarios to 2025 in France"

The ministries in charge of Environment and Agriculture in France ordered a scenario study on the possible futures of Agriculture and environment in France at the horizon of 2025. A mixed group of 35 researchers and stakeholders was gathered to build four possible scenarios, quite different one from another. Input from research programmes of MEDAD and from other institutions have been important in this exercise.

The scenarios resulting from the exercise are now being used :

- by the ministry of environment in order to open the debate with the ministry of Agriculture and other relevant stakeholders on the possibility of making an environmentally friendly agricultural scenario happen,
- by the research department at MEDAD in order to question the relevance of the research strategy of the National Agronomic Research Institute.

Example 5 – Technology foresight on environmental innovation in Sweden

In Sweden, a specific foresight exercise was conducted in order to foster the dialogue between the industry, the public agencies and the academia, on environmental innovation.

The procedure followed was to depart from the environmental policy agenda already planned, to derive from this agenda the technology needs in the future in order to implement this agenda (monitoring and remediation technologies), and then to assess the competitive advantage of Swedish R&D and industry for these various technologies, in order to identify the key technologies.

The output was twofold :

- a list of key technologies for competitiveness and environment policies
- an increased understanding for global environmental challenges.

From these diverse examples, we can see that there is wide variety of procedures in which a foresight approach can be inserted and put into use with respect to research strategy development. It would not be useful to try and homogenize completely these contexts. But we also gather a few differentiating factors that might help organizing our understanding of this diversity.

First, there is a question of scale. An exploration of future issues might be necessary within a research programme, at the time of setting new priorities for a new phase of the programme. But such a foresight exercise might also be useful at a broader scale, before creating a new programme, for example if it becomes necessary to choose to create only one programme among two or three possible ones : an exploration of future issues might be an argument in favor of a particular programme, among other arguments.

Secondly, the relationship of research planning to the policy agenda might be quite different. On one side, the research planning exercise consists of translating a policy agenda into research and innovation needs. On the other side, the research planning exercise tries to pre-plan research that will be used to put emerging issues on the policy agenda. In the latter case, an exploration of future issues is central to the procedure, and in the first case, an exploration of possible technology changes seems more than useful.

A third point of differentiation consists of the degree of formalization of the strategic analysis of research strategies. In some cases, an exploration of the future is used only as a brainstorming phase aiming to produce a first list of possible themes for new research programmes. In some other cases, a complete foresight procedure is implemented and the ranked future issues for research are the basis for a complete Strengths-Weaknesses / Opportunities-Threats analysis aiming at evaluating if the existing research strategy is robust or not to these emerging future changes.

Lastly, there is a question about producing specific materials for the research strategy development procedure, or using existing materials. In some cases, it appeared useful to engage people developing a research strategy in a specific collective phase of foresight, in some other cases, it was thought more useful to use existing foresights to assess the robustness of the research strategy.

PANORAMA OF EXISTING WATER FORESIGHTS IN EUROPE

After this presentation of the general rationale of foresights, and of the diversity of existing approaches, this last paragraph intends to present the few existing foresight exercises existing in Europe. Of course, the implementation of the Water Framework Directive led to the realisation in various districts of 2015 baseline scenarios, that could be analysed as foresights : but they are the object of another report within the IWRM Era net.

Here, we focus on water foresights for research, and we build on following materials :

- the workshop "European water scenarios" organised by DG Research in 2003,
- the EEA Outlook report,
- the European Foresight Monitoring Network (EFMN : http://www.efmn.info)
- consultation of researchers and experts for the organisation of a workshop in Liège in June 2007 in the framework of IWRM.Net.

It appears that United Kingdom is a country where Foresight is seen as a common procedure for research planning, and examples of foresights focussing on environmental issues come from the Foresight Office or from DEFRA, the Departement for environment, food and rural affairs. But none really deals with the integrated management of the water resources. They might be interesting examples, though, of foresight products and processes. For instance, the report "Making space for water" (http://www.defra.gov.uk/ENVIRON/FCD/POLICY/STRATEGY/1STRES.PDF) focuses on the issues concerning future flood risks, builds mainly on a wide consultation process involving experts, citizens and decision makers, and results in recommendations for policy makers, the new strategy for flood and coastal erosion risk management for England that should cover the next 20 years, where consequences concerning the research agenda is only a second priority.

Another quite different type of water foresights is a dutch foresight focussed on hydrology as a discipline, and it mainly consists of a strategic appraisal of opportunities and challenges for the national academic community of hydrologists in the international evolution of hydrology.

A third type of water foresights can be found in water companies. For example, Wessex Water conducted a Vision exercise where a consultation process led to the collective identification of common goals for a future sustainable water company in Wessex.

The most interesting project to be connected to IWRM.Net is still at the stage of being implemented. It has been launched in the framework of the ForSociety ERA Net that gathers Foresight specialists all over Europe. One of the concrete projects undertaken consists of a "Small Foresight Project on Water Management in Central and Eastern Europe", conducted by IFOK, the German institute in charge of the national Foresight programme called FUTUR. Specific connection points between IWRM and this project would probably be very useful.

The last type of existing examples is generally not named foresights, because it consists of research projects dealing with future evolutions of water systems. Many modelling exercises conducted by researchers can be used in a forecasting way, and therefore can help structure our understanding of the impact of evolutions of society and activities on the hydrosystem. Examples of such projects can be found for example on the Elbe river with the GLOWA project conducted in Germany, or on the Seine river basin in France with the PIREN Seine project, or in Quebec with OURANOS : in these cases, impacts of climate change are often at the centre of the analysis, but other important evolutions are also taken into account. Results of these modelling exercises are important as a source of information for research planning and for policy planning. Their main advantage compared to foresight exercise is that anticipations of the future are very robust because they rely on academic review. Their main limit is that the scenarios used upstream from the model might be too business as usual, and that they might fail in detecting important factors of change that lie outside the scope of the structure of the model.

An interesting example of a modelling exercise to build a baseline scenario is represented by the Water section of the EEA's Outlook report. In this case, the WaterGap model, specialised on water quantities at the watershed level, was used to compute the impact on water of the baseline scenario for society and activities in Europe that had been decided upon by a group of experts for all sectors of interest (not only water). Other qualitative assessments were made by group of experts for water issues where no model was available at the European scale. The first objective of such a scenario exercise was to explore the sustainability of baseline projections (to 2020-2030), which could possibly lead to plead in favour of more environmental action (early warnings for policy makers), if environmental objectives seem not to be reached with the baseline scenario. The second objective of such a baseline scenario exercise is to highlight the interactions between and the implications of sectoral developments and environmental issues.

An other important research project linked to water foresights is the SCENES Project ("Water Scenarios for Europe and Neighbouring States", an FP6 project; http://www.environment.fi/default.asp?contentid=249174&lan=EN), also at the stage of being implemented. It also uses the WaterGap model, but will function at various scales in Europe, the Mediterranean and the Black Sea. The main objective is to build a set of contrasted scenarios at various scales, rather than a mere baseline. These scenarios will be designed by a group of experts and stakeholders at the various scales, interacting with the modellers. These scenarios are supposed to reveal needs for action at the various scales and also at the European scale thanks to a transversal analysis. It is also very important that the foresight process of IWRM.Net can be connected and if possible coordinated with the SCENES project.

CONCLUSION : THE RELEVANT QUESTIONS TO DESIGN A FORESIGHT PROCESS FOR WATER RESEARCH

We can see from these various examples that there are a variety of procedures for the strategic translation of future issues into research strategy or into public policies.

It is therefore necessary to understand which specific procedure we want to impact on (policy development or research strategy design, formalised or less formalised…), and to derive from that the specific output that would best fit into the procedure and also have the most impact on it. Nevertheless, we have to bear in mind that the objective is always twofold : producing new insights on future evolutions, and fostering dialogue among partners and stakeholders.

Based on this expected output, it is possible to design the whole foresight process :

1) who should we associate to the process ? whose concerns do we want to address ?
2) what information should we be looking at ? what techniques or tools do we want to use ?
3) who do we want to consult for more creativity and in order to cross perspectives ? do we want individual consultation through questionnaires or a collective consultation through workshops ?
4) how should we process and classify the information gathered ? should we build some scenarios and if yes what kind of scenarios ? should we use ranking criteria and if yes what criteria are we selecting ? do we want to associate stakeholders to this processing phase, and if yes, in an individual or a collective way ?
5) even if the procedure using the outputs of the future looking process is already fixed from the beginning, how do we organize the discussion of these outputs ? do we propose to open the discussion to more diverse stakeholders ?
6) is it possible and relevant to use the outputs of the future looking process for broader communication purposes, in order to launch a broader debate ?

A selection of references :

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P.W.F van Notten, J. Rotmans, M.B.A van Asselt, and Dale S. Rothman, An updated scenario typology, Futures 35:5 (2003) 423-444.

European Environment Agency (2001) *Scenarios as tools for international environmental assessment,* Environmental issue report n°24, Expert's corner Prospects and scenarios n°5, 31pp. ISBN 92 9167 402 8

A list of websites concerning foresights :

The ForSociety ERA net :

http://www.eranet-forsociety.net/ForSociety/index.html

The Website for Foresights at DG Research :

http://cordis.europa.eu/foresight/home.html

COST action A 22 on "Advancing Foresight Methodologies: Exploring new ways to explore the future"

http://www.costa22.org/

The European foresight monitoring network (on technology foresights)

http://www.efmn.info/

The ForLearn platform to support mutual learning among foresight practitioners :

http://forlearn.jrc.es/index.htm

An online foresight guide :

http://forlearn.jrc.es/guide/0_home/index.htm

The EUROFORE project for mapping of existing foresights

http://prest.mbs.ac.uk/eurofore/partners.shtm

A list of websites presenting environmental foresights and scenarios :

The ForeScene Project on scenariosto support the EU sustainable development strategy :

http://www.forescene.net/Project.htm

The EEA's Scenarios on land use : PRELUDE

http://www.eea.europa.eu/multimedia/interactive/prelude-scenarios/prelude

The IPCC's Scenarios on climate change

http://www.ipcc.ch/

The Millenium Assessment's Scenarios on the future of ecosystems

http://www.millenniumassessment.org//en/Products.Global.Scenarios.aspx

The Global Scenario Group's Scenarios :

http://www.gsg.org/