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*Dialogue*

# Visioning Change and Alternative Futures: Foresight as a research and planning tool

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ABSTRACT *In this article, we motivate the use of foresight as a tool for research and policy planning, and draw examples from a number of foresight studies that have been done to envision global change and to better understand their underlying drivers. We point to the weaknesses that some foresight studies have had – in terms of their ability to speak directly to the needs and concerns of policymakers – and point to ways in which foresight practitioners can further enhance the applicabililty of their studies to policy questions and strengthen the role that foresight can play in decisions support. We argue for the local customization of global assessments to provide the momentum for more useful country-level foresight studies, and for the combination of thought-based 'mental models' with numerical and computational modelling tools, to enhance coherence and internal consistency of foresight assessments.*

KEYWORDS *foresight; environment; agriculture; quantitative modelling*

## Introduction

In a complex and fast-changing world, decision-makers often need guidance in discerning the key 'drivers of change' that matter – and understanding how they can be influenced to affect future outcomes. This need applies at both the policy level, as well as within the private sector. All decision-makers who have certain objectives in mind need to understand the concrete actions that need to be taken now in order to achieve those goals later, especially when there's uncertainty about how other drivers might affect those outcomes along the way.

Within a planning context, it is necessary to adopt a forward-looking perspective that accounts for how various drivers of change will affect those outcomes and processes that are of most importance. Often, there are multiple actors (or agencies) that exert an influence on the evolution of a given variable (the accumulation of capital, the development of a technology, the growth of inflation in an economy etc.), and they can act in sometimes unpredictable ways to shift the trajectory of that variable over time. Many of these factors are outside of the immediate control of the decision-maker, but he must, nonetheless, anticipate alternative cases in which those influences can evolve, in

order to anticipate what mobilization of effort and resources will be necessary to achieve an objective under those circumstances.

Foresight has been widely adopted as a tool for organizing forward-looking planning and thought processes, by industry, government agencies and research organizations, so that a coherent and internally consistent mechanism can be created for investment targeting, prioritization and resource allocation. In this article, we address the application of foresight to looking at studies of agriculture – and how it fits into larger ecosystems, as they evolve under future policy-driven environmental and socio-economic outcomes.

Foresight exercises are often built around the development and analysis of plausible pathways over which events may unfold, and which are embodied in alternative cases that may be taken into consideration, that is, scenarios. The building of scenarios provides a means whereby potential future occurrences and the uncertainties that surround them can be assessed in a structured, yet creative manner (Zurek and Henrichs, 2007). Scenarios create narratives about future occurrences and how these may unfold according to 'if-then' propositions, and they can be constructed upon the basis of either qualitative or quantitative information or a combination of both. Their use often involves the creation of multiple alternatives that are later compared with each other as a means of determining the most accurate and useful predictor among several (Raskin, 2005). The rather elaborate narratives that can develop around alternative scenarios are sometimes referred to as 'storylines', as they provide a detailed description of the overall political, technological, environmental and socio-economic environment that underlies a given 'state of the world' and determines how it will evolve further over the projected future.

Scenario-based foresight exercises are especially appropriate when assessing the high levels of uncertainty that accompany future movement in complex systems. Depending on the timeline of the assessment, foresight exercises involving scenarios may require a reduction in the complexity of a system that can be achieved by an examination of only a part of the system or a focus on a single question within a scenario (Zurek and Henrichs, 2007). Therefore, foresight exercises – while impossible to conduct without some exploration and recognition of the contributing factors and the complex global system within which they exist – can, nonetheless, be simplified by bringing together the most pertinent elements that define it. These elements will usually include a set of main questions, systemic driving forces, the basic overarching logic and decision-making paradigms used in each scenario and a breakdown of future outcomes that may interest stakeholders.

Scenario-based foresight exercises should, however, be clearly differentiated from other types of naïve foresight, which can range from forecasts, predictions, projections and all the way to pure speculation. Figure 1 illustrates the differences between these, in terms of the degree to which there is uncertainty about the nature of future drivers and outcomes, and the degree of complexity that is embodied in the processes of change.

Unlike these cases, scenario-based foresight exercises do not assume that the world, regardless of the passage of time, remains in its present boundary conditions. On the contrary, it is often based on the assumption that these boundary conditions will be subject to substantial change in the future. Therefore, they allow decision-makers to think through the implications of actions they decide to take in the present while remaining cognizant of

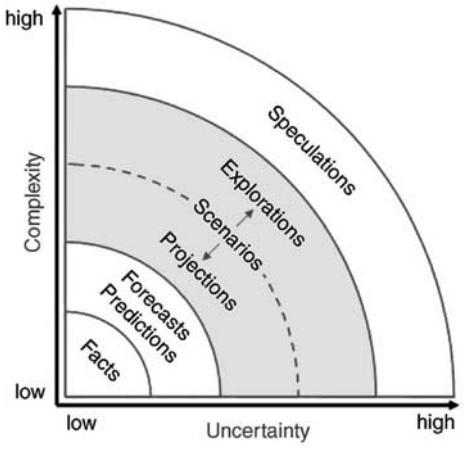


**Figure 1:** *Contrasting fact, forecasts, predictions and speculation*
*Source*: Zurek and Henrichs, 2007.

the fact that decision-making conditions as they exist today could potentially be vastly different in the future. This helps to drive considerations of changing processes and causal chains that impact the future (Rotmans *et al.*, 2000).

## Foresight as a visioning process

### *Background*

For many organizations, the value of foresight lies just as much in the process that is created by carrying it out as it is in the final outcome of the process. In some cases, foresight can be a one-time exercise that is carried out to address a particular question, or to meet a defined objective, such as to define which strategic direction to take at a critical juncture in the planning and growth process. In other cases, foresight might be part of a periodic process of visioning and scoping that is part of an internal organizational priority-setting process that allows decision-makers and resource managers to periodically challenge currently held assumptions and to re-examine priorities in light of a changing global environment. While some agencies might require outside expertise and guidance in order to carry out a foresight exercise, other organizations might have internal specialists who can carry out periodic foresight assessments 'in house', as the need arises.

In this article, we look at cases in which foresight has been applied to envision the future of agriculture, particularly with regard to understanding the interactions with the environment and policy influences. The linkage between agriculture and the environment has been one of active researchers, given the complexity of the relationships between the various sub-components of terrestrial ecosystems – of which agriculture is one – and the importance of certain 'services' that come from ecosystems, such as food.

We will examine the strengths and weakness that various foresight exercises have had in influencing and guiding policy around agriculture and the environment, or in changing the way in which the scientific and wider public views these issues. The examples that we will discuss will point to ways in which the uptake of foresight for guiding and informing decision-making can be enhanced and expanded.

### *The role of modelling*

Models can play an important part in foresight, by helping to organize information and systematize how hypotheses, assumptions and data are made use of in the processes. These models can be either purely mental constructs or actual numerically based computational tools – as the need demands – and both can interact in useful ways. There are often strongly qualitative aspects of foresight analysis, especially when it is used within a purely 'visioning' process of constructing a collective consensus around what is important in affecting future outcomes of concern. In this case, the foresight analysts create 'mental' models of how the various drivers of change lead to future outcomes, and use basic reasoning or arguments to talk through the causal chain that leads towards them. This helps to direct 'group think' and give all the participants in the foresight process – if it is done in a collective and consultative manner – a conceptual framework around which to structure discussions and debates.

The quantitative dimensions of visioning future change – such as expecting population or economic growth – are usually carried out with the help of computation-based numerical models that represent the relationships between the drivers of change and the expected outcomes as a mathematical relationship that can be empirically specified with the help of data. These can be the extensions of the mental models, or based (in terms of their design) upon a more qualitative description of systemic linkages between key components of the environment, ecosystem or the economy. They have an advantage over 'mental' models, as they impose a level of internal consistency that would otherwise be lacking in purely 'group think', by forcing things to add up, imposing balances or demanding specificity in certain relationships that the 'mental' model can only describe in rough and imprecise terms. Their weakness, on the other hand, lies in their very dependence upon data that would be needed to empirically specify these relationships, over which there is usually some degree of uncertainty. To the un-initiated or naïve user,

they might encourage a feeling of precision where this might not actually be possible, given the nature of underlying structural uncertainties.

We argue for a combined approach – given that the quantitative models can serve to 'check' mental models, and enforce a level of internal consistency and fidelity with known empirical relationships – whereas the 'mental' models can more easily address the qualitative dimensions of foresight that cannot be directly measured, observed or empiricized for a numerical tool. In the examples of foresight that we will discuss, in the following sections, we will point out how these dual approaches were used or combined in various studies.

## Examples of foresight for agriculture and environment

In this section, we draw upon several examples to illustrate how foresight was used to organize thinking about critical environment–ecosystem–economy interactions that are of importance when thinking about agriculture and how it affects future levels of human security and well-being. These are a subset of a much larger body of foresight studies, but serve as useful points of illustration for our arguments.

### *The Millennium Ecosystem Assessment (MEA)*

The MEA (2005) was a multi-institutional, multi-stakeholder process that brought together high-level scientists and research organizations to provide a better understanding of how the health of ecosystems, the services they provide (food, fibre, temperature regulation etc.) and human well-being might be affected under alternative, policy-driven futures. The MEA helped to bring certain important concepts of ecosystem and sustainability science to the fore of public discussion and to 'concretize' them in the minds of the policy and scientific community, such as the importance of distinguishing between the welfare-enhancing services of ecosystems that are more regulatory in nature (such as temperature control, nutrient cycling etc.), and those that either provide consumables (e.g. food, fibre, energy etc.), or which have cultural importance. In essence, the MEA changed the way that the public talked about the importance of ecosystems and how human activity interacts with them to impinge upon their functioning while deriving benefit from the services they provide.

The MEA, however, has not proved to be as influential a tool for guiding policy and decision-making. Its thorough and comprehensive treatment of the subject was, in some ways, the barrier to its dissemination. The multiple, large volumes of technical data that the study produced served to put off many non-technical, 'lay' persons who then relied upon the 'summary for decision-makers' volume, or perhaps an even more abbreviated synthesis. Given the complexity of the study, it was extremely challenging to distil simple, practicable messages from the outcomes and conclusions of the study that would have strong resonance with the reader and speak clearly to a particular course of action. As is often the case, the time and resources for doing the study are usually well depleted by the time it comes to promoting, disseminating and doing intensive outreach on the product itself, and it takes some time for the messages of the study to be 'absorbed' in the minds of the public, for follow-up advocacy to be effective.

One of the key features of the MEA was that it used a 'storyline' approach to motivate the thinking of how alternative trajectories for some of the key drivers of change could be influential in how future outcomes of environmental and human well-being evolve in the future. The four 'worlds' that were imagined combined both the geo-political dimensions, along with the economic and technological dimensions, such that there were cases in which technology innovation was adopted more aggressively than in others, or where regional cooperation (at either a scientific or political level) took place more readily, compared with a fragmented and uncoordinated approach. These alternative cases effectively drew a distinction between the 'fortress' world where there is little incentive to cooperate or share knowledge and resources (and where human well-being outcomes are worst), and a more pleasant world where innovations abound are freely shared, facilitating faster socio-economic and technological progress,

as well as a healthier environment. These storylines provide a useful way in which to organize the discussion among and between scientists and other stakeholders, so that their mental models and conceptualizations of how socio-economic and environmental indicators might change under different forces can be linked with quantitative, numerical models that can simulate the impact of these driving forces on various aspects of environmental quality and ecosystem health, as well as socio-economic outcomes.

This approach was also used in the other studies that we describe here.

### *The Global Environment Outlook (GEO)*

The GEO is a periodic global assessment that is carried out by a particular agency of the UN system – the UN Environment Programme (UNEP) – as a way of mobilizing awareness around the environmental issues they advocate for. The 4th GEO assessment (UNEP, 2007), in particular, bore a strong resemblance in its structure to the MEA, in that it used a set of storylines or alternative futures to mobilize creative discussion among key stakeholder groups about the various drivers of socio-economic and policy influence that impact key sectors of the environment (land, water, biodiversity etc.).

Similar to the MEA, the GEO-4 assessment engaged research teams and stakeholders to think about the key storylines (Policy First, Markets First, Security First and Sustainability First), and how they influence future socio-economic and environmental outcomes in both qualitative and quantitative terms. Unlike the one-time MEA, however, the GEO assessment is meant to be an ongoing and flagship product of UNEP that helps to bring attention to the state of the environment, and the important drivers affecting its evolution. The fact that the GEO assessment (now past the 5th assessment) has a clear institutional 'home' means that it is able to have further-reaching influence, and ongoing dissemination support, compared with an assessment that is only done once and which is not, ultimately, owned by a particular institution that can champion its findings beyond the end of the actual assessment activities.

### *The International Assessment for Agricultural Science and Technology for Development (IAASTD)*

The IAASTD (2009) was another one-time assessment that was designed to be a process that brought together experts and stakeholders from science, industry and government to think about the important drivers affecting agriculture and human welfare in the future. The focus on agriculture, in particular, was towards the role that science and technology can play in accelerating the accumulation of knowledge and intellectual capital in the agricultural sector such that the productivity of the actors within agriculture increases and boosts the overall performance of agriculture and the well-being of the people who depend on it.

Initially, the IAASTD had tried to repeat a similar 'storyline' approach to building future scenarios – like in the MEA or GEO-4 assessments – but decided to switch to a simpler scenario approach (where a baseline case is presented along with other illustrative variants imposed one by one). This change came about as a result of feedback from stakeholders who had difficulties understanding (or appreciating) the storyline approach, and wanting to have a more simplified framework.

In the case of the IAASTD, the uptake of messages that came from the assessment were somewhat limited by the fact that some of the key organizations that could have facilitated its uptake and outreach to government-level decision-makers did not fully 'buy in' to the final conclusions of the study. This lack of widespread endorsement, along with the absence of a home institution that could continue to promote and disseminate its messages, post-assessment, created limits to its effectiveness. Whereas some individuals associated with the study might continue to talk about the IAASTD and its findings, this cannot be compared with the full institutional backing that the GEO assessment receives.

### *The Comprehensive Assessment of Water Management in Agriculture (CA)*

The 'CA' was led by a single agency within the Consultative Group for International Agricultural

Table 1. *Summary of key components of various assessments*

| | Alternative story-line approach | Baseline +scenario variants | Have regional sub-assessments | Ongoing/ continuing | Have companion studies, sub-components |
|---|---|---|---|---|---|
| Millenium Ecosystem Assessment (MEA) | X | | | | |
| GEO-4 | X | | X | | |
| IPCC (4th assessment) | X | | | X | X |
| IAASTD | | X | X | | |
| Comprehensive Assessment of Water Management in Agriculture (CA) | | X | | | X |

Research (CGIAR) (see http://www.cgiar.org/) consortium – the International Water Management Institute (IWMI) – although conducted in collaboration with a number of institutions and partners. The assessment was designed to draw attention to the importance of good water management in agriculture and its consequences for food security (Molden, 2007). Aside from the forward-looking projections and scenario studies done by IFPRI, it was one of the few major foresight exercises carried out within the CGIAR.

Like the IAASTD, the CA eschewed the more complex approach of creating alternative 'worlds' with corresponding storylines, in favour of a simpler 'baseline+variant' scenario approach for ease of interpretation. Likewise, the CA was also conceived of as a one-time study that has not been repeated since then.

### *The Intergovernmental Panel on Climate Change (IPCC) assessment process*

The IPCC is, like the GEO, an ongoing process that brings together scientists and key stakeholders to apply their best efforts in understanding the evolving implications of global environmental change. The IPCC process, unlike many of the assessments mentioned previously, has the full endorsement and support of the international science and policy community, as well as by the national governments that are stakeholders in the process. This creates a strong mechanism for catching the attention of policymakers and a clear pathway for uptake that many of the other assessments lack. The IPCC has taken an extremely rigorous approach to handling 'evidence' from the literature and from commissioned analytical work, which many collaborative scientists find appealing and a good motivation to engage in the process.

Past IPCC (2007) assessments, such as the 4th one, have take a 'storyline' type of approach to describing how patterns of economic growth and policy action leads towards differing levels of greenhouse gas emissions and their cumulation in the atmosphere. Like the MEA and GEO-4, this allowed for multiple influences within the storylines to act upon the trajectory of environmental change, for example $CO_2$ atmospheric concentration, and temperature and precipitation. The implications emerging from the IPCC process have generally been fairly clear-cut in terms of pointing out which technologies and (climate mitigating) policy actions lead to better environmental outcomes, and the results of the assessments tend to be very widely publicized and discussed.

Given the inter-governmental structure of the IPCC process, it is, perhaps, one of the foresight efforts with the greatest influence on thinking about environmental futures in both policy and scientific circles.

Table 1 gives on overall summary of each of the assessments that have been discussed, to give the

reader an overview of the key characteristics of each. The following sub-section discusses some key dimensions of each assessment that are relevant for the decision-making process.

## Enhancing the decision support role of foresight

In each of the foresight assessments that we have discussed, there is a 'message' that can be conveyed to decision-makers with regard to the types of actions that can lead towards desired (or undesirable) outcomes. The messages from the IPCC are clear about the role of emissions-avoiding and carbon-sequestering technologies, and their implications for future global environmental change. The MEA and GEO-4 assessment illustrate the trade-offs between focusing on fast socio-economic growth as a first priority versus considering environmental sustainability, in terms of its impact on land conversion, water depletion and quality and degradation of the ecosystems. The MEA and GEO-4 storylines also convey the pros and cons of having a proactive versus reactive policy regime as well as the benefits of policy coordination (and the costs of failing to coordinate or exchange goods and ideas freely). These types of messages speak more to the way in which global environmental and economic policy coordination needs to be improved, and does not necessarily give actionable advice for individual countries to follow. It is impossible, for instance, for a single country to act on its own to reverse the trend of global greenhouse gas emissions that strengthen the trends towards future climate change. But a coordinated effort among the top emitters, on the other hand, could make enough of a difference to change some trends, and to build momentum towards global conventions and mechanisms for monitoring and controlling flows of carbon to occur. So rather than speaking to a single decision-maker (or the decision-makers of a single country), these messages are more aimed at pushing forward the case for urgent dialogue and negotiation among a wider group of decision-makers at the global level. The major institutions of global governance, such as the UN system – both through the UNFCC, other UN agencies (like UNEP) and multilateral bodies such as the World Bank – have the convening power and platform to strengthen these messages and disseminate the findings.

The CA of IWMI, on the other hand, speaks to questions of water management that might have more resonance at the country level, especially if they concern key water basins and water use practices in agriculture or industry that can be acted upon by country-level resource managers and decision-makers. There is less of a 'global commons' dimension to water – compared with atmospheric carbon emissions, for example – although there are still some transboundary issues to be confronted. This is especially true where rivers or aquifers traverse country boundaries and require neighbouring countries to coordinate their policies to bring about effective management of the shared resource. The CA contained a number of companion studies that focused on various issues – rainwater harvesting, groundwater management, soil-water management etc. – that might have stronger resonance in some countries than others, depending upon the nature of the resource problem faced. This might make it easier to tailor the recommendations to directly support country-level decision-making that might be taking place around these issues.

In the case of the IAASTD, there are also some 'messages' relating to the management of agricultural science and technology that could resonate with decision-makers at the country-level. The question of falling and inadequate levels of agricultural investment, as an example, touches on issues that countries must take into consideration, when doing their own internal priority setting for investments in capital and technologies around various sectors. There would probably need to be more detailed studies at the country-level in order to make more concrete recommendations as to precise targeting and timing of science and technology investments at the country-level. This was beyond the scope of the IAASTD process, but the assessment provides some insights into the benefits that could be realized by better-targeted and more effective spending on agricultural science and technology. There were some sensitive issues of GMOs and how various biotechnologies should be handled, relative to more 'traditional' technologies and practices that the IAASTD study was not able

to fully address. This was partly because of disagreements and lack of consensus on some issues, and partly because of limited time and funding for the study, but there is definitely more that needs to be done on this in order for the assessment to provide useful decision support to country policymakers on how to deal with GMOs and invest in biosafety systems that can handle GMO-based technologies in an acceptable way, such that effective segregation from non-GMO technologies is achieved, and that public sensitivities to the deployment of GMO technologies in the food chain are effectively addressed.

In the end, the most effective way for these rather large-scale global assessments to play an effective role in country-level decision-making is for a country-level foresight exercise to build off of a particular aspect of one of them and pursue it further with respect to a well-specified set of issues. Such 'mini-assessments' – if they were to involve local stakeholders and could adapt some of the global storylines to fit better within the specific country context – could prove to be the most useful for the decision-makers in those countries. There would probably need to be a partnership between the international bodies that sponsored the original assessments and the local foresight team, so that the modelling tools and other useful insights and experiences could be transferred, with the appropriate level of resources allocated to support consultations and dialogue. The mechanism for facilitating this process has, of yet, to be established on a large scale, although there are efforts at building country-level capacity in foresight analysis by such organizations as the Global Forum for Agricultural Research (GFAR), which is sponsoring a 'Foresight Hub'[1] to gather the experience of practitioners and experts in the field, so as to disseminate their insights and train the next generation of country-level practitioners.

## Conclusions

In this article, we have touched upon a number of significant forward-looking assessments that are good examples of how foresight could be used as a research and planning tool. We pointed out the strengths and weaknesses of the various assessments in terms of their effectiveness in conveying important messages regarding policy priorities and trade-offs between socio-economic growth and environmental well-being, but also in their ability to relate directly to country-level decision-making. Some assessments have a more global focus, and might speak more strongly to the importance of coordinating global governance within the context of multilateral institutions and initiatives, whereas others might touch on issues that are more actionable at the country or regional level. Each of these assessments adopted a different approach to constructing scenarios or 'storylines' that describe how important drivers of change could affect future outcomes, with some adopting for a more simple 'baseline+variant' approach, versus describing 'alternative worlds' that could result from different socio-economic and geo-political trends and tendencies. Determining which of these approaches is more effective in communicating to policymakers is a task that the foresight team has to consider, in light of the kind of issues they want to focus on and the messages they wish to convey.

We have also argued for a combination of 'mental' and computational or numerical modelling to address both the qualitative and quantitative dimensions that a foresight exercise might consider, and to provide some 'checks' and enforcement of internal consistency (both from a numerical and logical point of view). This requires a multi-faceted, transdisciplinary approach, so that the efforts of the 'thinkers', modellers and facilitators can all be coordinated to bring about a coherent view of how both the various drivers of change (whether qualitatively or quantitatively described) are evolving to bring about future changes.

In the end, global assessments have to be brought down to the country level in order to be sufficiently adapted and customized to meet the decision-making needs of policymakers and resource managers within a particular country. This will likely happen in a piecemeal fashion, as funding opportunities for research projects arise and create the opportunities for these types of country-level studies to happen. But the active engagement of bodies like GFAR through expert forums such as

the 'Foresight Hub' might accelerate this process, and provide useful opportunities for training, capacity-strengthening and the sharing of valuable experiences gained by knowledgeable practitioners, thereby creating opportunities for cross-country learning and dialogue.

## Note

1 The interested reader can follow this link http://www.egfar.org/forums/global-foresight-hub to learn more about GFAR and the Foresight Hub.

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