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The use of foresight in setting agricultural research priorities

Marie de Lattre-Gasquet[1]

Foresight activities can be useful tools in public decision-making processes, and in particular for agricultural science and technology priority setting. Foresight complements more traditional ways of looking at the future, such as projections and models. Foresight uses a systems approach that is appropriate for agriculture and can be embedded in research organizations. This chapter describes three foresight exercises. The exploration of possible futures for a commodity (cocoa) has helped defining new research priorities, partnerships and networks. The Dutch exploration of the challenges facing agribusiness, rural areas and fisheries, and the contribution of S&T to meeting these challenges, created new networks and led to actions. IFPRI's '2020 Vision' for food, agriculture and the environment led to interesting data and reached many researchers, but did not manage to generate consensus about research priorities. Finally, the chapter discusses the prospects for the use of foresight in developing countries, especially in Africa.

1 Introduction

A recent review of science and technology plans in Africa, Caribbean and Pacific (ACP) countries concluded that 'agriculture in general and agricultural S&T in particular do not have the priority which should be expected on the basis of the sector's importance in the countries' GDP. One may even ask to what extent tropical agricultural S&T development is surviving as a global public good'.[2] According to the *UNESCO Science Report 2002*, the state of S&T in most African countries has deteriorated substantially since the early 1980s. 'Severe cuts in government spending have pushed institutions of higher education and research centres into steep decline. National educational and research coordinating bodies, once focal points of reform for S&T, have lost much of their political power and influence. Indeed a significant number of these reform-minded bodies have been dissolved'.[3]

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2 Box *et al.* (2003).

3 Gaillard *et al.* (2002).

As noted by the Senegalese historian Mamadou Diouf, there has been a major shift in 'the tension between internal constraints (human and material resources, cultural capabilities and predispositions, historical circumstances), which it is believed can be eliminated by sound policies on the one hand, and by adequate institutional arrangements on the other, and by the opportunities that globalization brings at different times and in different circumstances'.[4] What can be done to reduce these tensions, to develop the power and influence of education and research coordinating bodies? In particular, what can be done not only to devise solutions but to define the problem?

We believe that foresight is a useful instrument for public decision making in many areas, in particular in the area of agricultural science and technology (S&T) policies. Foresight is a process that leads to defining problems, thinking about possible futures and making choices, and complements more traditional ways of looking at the future, such as projections and models. The chapter describes three foresight exercises that explored possible futures for a commodity (cocoa), for a country (agriculture in the Netherlands), and for food, agriculture and the environment (IFPRI's 2020 Vision). Finally, the chapter discusses the prospects for the use of foresight in developing countries, especially in Africa.

2 The use of foresight in agricultural S&T priority setting

Foresight has been described as 'the process involved in systematically attempting to look into the longer-term future of science, technology, the economy, the environment and society with the aim of identifying the areas of strategic research and emerging generic technologies likely to yield the greatest economic and social benefits'.[5]

Although the future is unpredictable, some developments can be foreseen and alternatives explored. Therefore, there is the possibility of preparing for the future (within limitations) or to try to shape it directly.[6] Foresight is neither prophecy nor prediction, but 'invites us to consider the future as something that we can create or build rather than as something already decided. … The philosophy behind the procedure is that the future is a realm of freedom, of power and of will. It is at once a land to be explored, hence the utility of vigilance and anticipation, and in particular of the exploratory perspective, and a land to be built on, hence the utility of investigating desirable futures and looking at the policies and strategies that can be adopted to achieve them'.[7]

Foresight assumes that there are numerous possible futures, any of which can be created through the actions we choose to take today. It is not so much concerned with predicting as with inventing or shaping a chosen future from the infinite range of possibilities. Foresight is not only understanding the system and looking into the future, it is also a collective learning process with a view to long-term strategic decision making. It therefore covers activities aimed at thinking about, debating and shaping the future.

The foresight process involves four stages. It starts with defining the problem, choosing the time horizon, setting the organizational framework and choosing experts. The second stage

4 Diouf (2003).
5 Martin (1995).
6 See Cazes (1986), Hatem (1993), Gonod and Gurtler (2002), Cornish (2004).
7 De Jouvenel (2004).

consists of constructing the system, identifying key variables, gathering data and drafting hypotheses. This stage is followed by an exploration of possible futures and scenario writing with the help of tree structures. The final stage involves outlining strategic choices, disseminating results and recommending a strategy (figure 1).

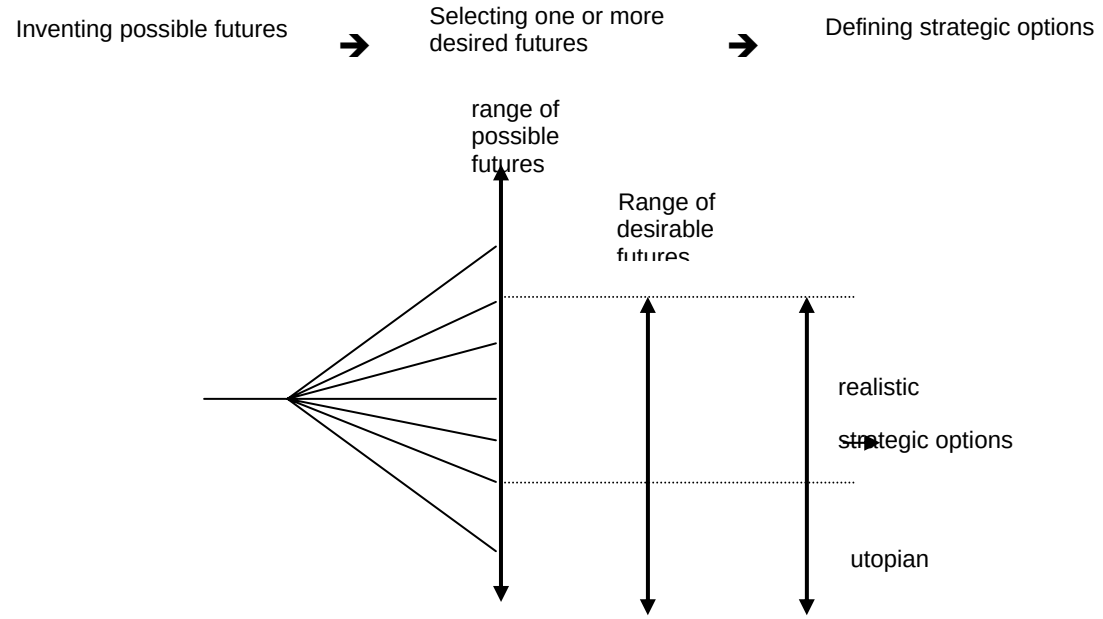

Figure 1. Strategic foresight (adapted from de Jouvenel, 2004).

During the process of exploring possible futures, the mental maps of the 'foresighters' must be stretched, since there can be a tendency for scenarios to strengthen existing beliefs. Creativity can be tempered by the need to be both credible and consistent. Often, final scenarios are judged by how well they fit with expectations about the future. Among all possible futures, some are desirable and others are not. Among the desirable futures, some are realistic and can help decision makers choose strategic options, while others are utopian. There is an almost natural inclination of participants to confuse the (un)thinkable (utopian) with the (im)probable or (un)realistic.[8] Once the strategic choices have been outlined, decision makers can examine their implications and take the decisions they find most appropriate (figure 2).

At the centre of the process is the interplay between anticipation, appropriation or collective mobilization, and action or strategic will.[9] For the participants, the foresight process can have a number of benefits, formulated as 'the 5Cs':[10]

1. *Communication* – among firms, industrial sectors, government and academia.
2. *Concentration on the longer term* – normally, day-to-day pressures force us to focus on the short-term, on 'firefighting' immediate problems, rather than contemplating what the world might (or could) be like 10-20 years hence.
3. *Coordination* – organizations can find out about what others are planning to do, and hence can coordinate their strategies more effectively.

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8 Van der Meulen *et al.* (2003).
9 Godet (1977).
10 Irvine and Martin (1984, 1989).

4. *Consensus* – generating a shared vision of what sort of world we would like to create in the longer term.
5. *Commitment* – by involving knowledgeable and enthusiastic individuals in the foresight process, one can foster their commitment to convert new ideas into action.

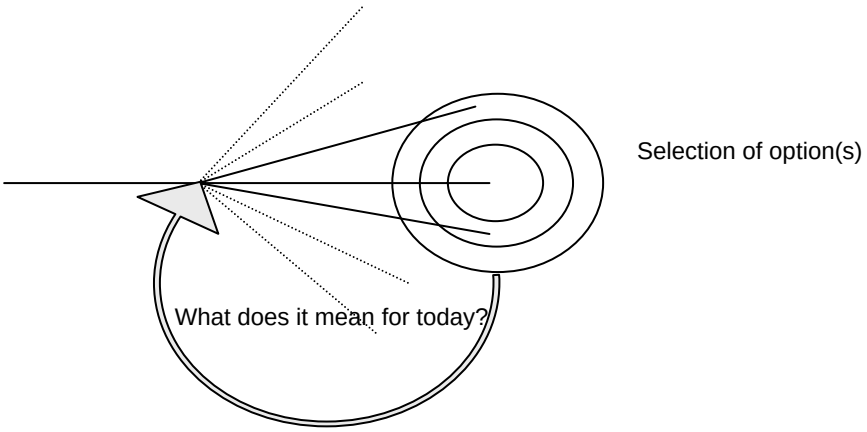

Figure 2. The decision-making process (adapted from de Jouvenel, 2004).

Agricultural forecasts, models and foresight

The future availability and prices of agricultural commodities are of interest to producers, national policy makers, traders, industry and international institutions. It is necessary to minimize and to cover risks, and to plan medium-term commodity policies. To understand what happened in the past and how it has affected the current situation, international organizations, national institutions and industry unions collect statistics on production, consumption and trade. Over the last 50 years there have been at least 30 quantitative estimates of future world food security, published regularly by the Food and Agriculture Organization (FAO) and the US Department of Agriculture (USDA), and occasionally by bodies such as the Organisation for Economic Cooperation and Development (OECD), the International Food Policy Research Institute (IFPRI), and the International Institute for Applied Systems Analysis (IIASA).[11] Although it is difficult to measure the precise influence of these forecasts on the actual policy debate, the fact that there are different players and models is in itself an indication of their perceived usefulness.[12]

To look at the future of production and exchange, most agricultural forecasts are based on two types of models: trend projections (or extrapolations) and world trade models.[13] In *trend projections* (e.g. of food supply and demand balances), relationships between variables lead to mathematical equations based on statistical series. The system is represented as it functioned in the past, and is used to project the future. There cannot be major changes from the past. These projections are useful for the short to medium term (one to five years).[14]

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11 McCalla and Revodero (2001).
12 Paarlberg (1999).
13 McCalla and Revodero (2001).
14 Griffon (2004).

Trend projections are temping for decision makers because they provide relatively simple answers to their questions, but they have limits.[15] First, the description of reality provided by the model depends on the theory used. Behaviours are stylized in mathematical functions, so that the underlying hypothesis must be simple. However, as the hypothesis is not always available to the users of the model, they tend to anticipate changes that might not occur because the theories used do not correspond to reality. Second, trend projections for commodities represent only a part of economic reality. They cannot take into account the rest of the economy. If they do, through an economic model, the variables used are often exogenous. Third, in most cases, trend projections do not take into account risks – they deal strictly with the probability of things to come. At best, uncertainties are made explicit, but only in order to better isolate the statistical features of future developments. In the agricultural sector, there are many unpredictable risks such as climate variations, wars, price fluctuations, etc. Inaccuracies in the data are another reason for the divergence between the results of a model and reality. Official national statistics do not always reflect reality, as satellite data on surfaces and yields have shown. The difficulty in representing the passage of time is another reason for the divergence between model results and reality. Changes in consumption, for example, can be much faster or slower than expected. Trend projections are therefore good for the short term, but they remain valid in the medium term only if they are constantly adapted.

Models such as IFPRI's Impact model and the FAO's World Food Model are systems of equations developed to represent how variables interact with a subsystem that has already been isolated. Estimating models based on historical trends have the advantage of transferring to the future the structure of the interrelationships among variables that were consistent in the past. Over the years, the number of issues related to the supply and demand sides of the food balance equation that are taken into account has increased significantly. Modelling approaches have become more sophisticated, larger, and much more expensive.

Foresight could be an alternative way to look at the future of agriculture and agricultural research, using a systemic approach. When socio-economic conditions evolved slowly, when technological progress was rare, farmers used their experience and knowledge to improve production and manage their environment. When those conditions started to change, farmers could no longer deal with the new context and needed help, and researchers tried to develop new techniques that they hoped would improve yields. Because of failures in the adoption of such techniques, some agronomists started to adopt a systemic approach, considering the field as a system, and then looking at interactions between the techniques. The 'systems approach' to agriculture developed from there on. Doing agricultural foresight therefore means defining and understanding the system before building scenarios or looking at innovative activities. Defining the limits of the system on which the foresight will concentrate, and defining the different elements, is often difficult due to the numerous interactions between the agricultural and other sectors.[16]

Beyond agriculture, the notion has emerged of the national (or regional) system of innovation, which is made up of a number of actors and the links between them. Foresight offers a tool for getting the individual actors in the national innovation system to communicate, to discuss issues of long-term common interest, to coordinate their respective strategies, and perhaps even to collaborate. Foresight with scenario building, foresight models and trend projections

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15 Godet (1977).

16 Researchers at the Institut National de la Recherche Agronomique (INRA) have developed their own method of foresight and have carried out exercises on oilseeds, vegetable and animal proteins, forestry, water, etc.

complement each other. Once scenarios are designed, it can be useful to use a foresight model with the variables defined in the qualitative foresight, and to model the different scenarios.[17]

3 Technology forecasting and technology foresight

For many years, technology forecasting involved continuous monitoring of technological developments in order to identify promising future applications and assess their potential.[18] Over the last ten years, technology foresight exercises have been conducted in Europe and Japan to identify key or critical technologies. These exercises, often government-initiated, have involved wide ranging government–industry discussions and gathering expert opinions on technology futures, leading in some cases to blueprints and government actions. In the United States critical technologies have also been identified, but through a different process.[19]

S&T foresight looks at science in progress ('*la science qui se fait*')[20] and fulfils a number of functions.[21] It provides a means for making choices in relation to science and technology and identifying priorities. It also offers a mechanism for integrating research opportunities with economic and social needs, and thereby linking science and technology more closely with innovation, wealth creation and enhanced quality of life. It can help to stimulate communication and partnerships among researchers, research users and research funders.

Drivers of S&T foresight

A number of reasons have been put forward to explain the growth of S&T foresight exercises, and of the various functions they are used to perform. Four major drivers have been identified.[22] The first of these results from globalization and growing economic competition. The growth of markets has put a premium on both innovation and knowledge-based industries and services. This in turn has given science and technology a greater importance and thus any tools that can assist in guiding investments in S&T have become important. Until the late 1980s, science operated under what might be described as the 'Vannevar Bush social contract'[23] – governments provided funding for scientific research in the expectation that it would ultimately yield benefits in the form of wealth, health and national security, but exactly what form those benefits would take and when they would occur were rather vague. Since the 1990s government expectations of their investments in science and technology have become much more explicit and specific, so that working with stakeholders to define and execute research activities has become indispensable.

A second driver is the increasing constraints on government spending, particularly in the public sector. Governments worldwide are faced with the twin forces of a declining revenue base (associated with high economic and political costs of deficit budgeting) and the growing

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17 Following the cocoa foresight exercise, a simulation using a world food security analysis model developed by Cirad provided information on the impacts of changes in cocoa production on prices and trade.

18 See ESTO (2001) and http://esto.jrc.es/monitoring_list.html.

19 Wagner and Popper (2003).

20 Latour (1995).

21 Johnston (2001).

22 Martin and Johnston (1999).

23 The legislation creating the National Science Foundation in effect established a social contract under which the government would pay scientists to engage in research of their own choosing, on the understanding that significant benefits would come back to US society in the forms of military security, public health and economic prosperity (Bush, 1945).

public demand for services such as health and education. They therefore need to be able to justify any public expenditure and to show that it is a valuable investment.

The third driver results from the enormous changes in industrial production. Command and control management has been replaced by decentralized decision making, empowerment and teamwork. Attention now is on customer-supplier relationships, and the development of strategic alliances and effective networks. The drive for controlled high performance through quality management has been extended with the new emphasis on learning and knowledge organizations.

The fourth driver has been the change in the process of knowledge production, which has become increasingly transdisciplinary and heterogeneous.[24] The range of producers of knowledge has expanded, with an emphasis on knowledge constructed in the context of its application. In this model, there is a need for communication, networks, partnerships and collaboration in research, not only among researchers but also between researchers and research users in industry. One of the challenges facing (agricultural) researchers is to identify the potential beneficiaries or users of the results of their research, and to work with them to ensure that the results are exploited quickly and effectively to maximize the economic and social benefits.[25]

A fifth driver has been the rapid development and the growing convergence of technologies that are likely to have a revolutionary impact on economy and society in the coming decades. Frequently, however, technology foresight concentrates on identifying promising future applications and assessing their potential, rather than focusing on future research questions. In this approach, the possibility of developing new products following scientific discoveries are of central importance, as well as the conditions of emergence, development and diffusion of technological innovations.[26]

Embedded foresight

Defining research objectives, setting priorities and allocating funds call for a long-term view. Over the years, methods have been developed for setting research priorities.[27] Rather than continue to rely on opaque bureaucratic decision processes, S&T policy makers are starting to use S&T policy evaluation and foresight systematically to help them make choices.[28] There is a move towards embedded foresight.

Embedded foresight refers to individual and collaborative processes through which information about relevant technological, commercial and societal developments is acquired, produced, refined or communicated within research programmes, in order to generate shared understanding of and support for research and development activities. Embedding foresight means linking it to evaluation, programme planning and priority setting. It implies the replacement of rigidly designed programmes by more flexible and learning-oriented programmes in which the priorities are continuously negotiated and revised if necessary.[29] Such a combination enables research organizations to consider themselves not only as

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24 Gibbons *et al.* (1994).
25 Martin and Etzkowitz (2000).
26 OECD (1996); see also Battelle (1996), Wagner (1997).
27 See ISNAR (2001) and www.isnar.cgiar.org
28 Kuhlmann *et al*. (1999).
29 Salo and Salmenkaita (2002).

problem solvers, but also as the architects of new futures, and not only as researchers but as co-innovators who are involved in the implementation of future prospects.[30]

Increased interaction between research evaluation, foresight and programme planning can enhance S&T decision-making processes. These three processes involve at least three parties – the commissioners of the exercise, internal members (i.e. evaluation or foresight group members), and external members (evaluators, stakeholders and others) – who can thus support one another. This arrangement can facilitate the formation of a common vision and ambition in which no single party – policy makers, industries, producers, community organizations or researchers – will dominate. It can create an atmosphere of dialogue and intelligent interplay between those involved, each retaining their own decision-making authority. Agreement can be reached on the division of tasks, and there can be increased cooperation in the financing, development and utilization of science and technology. This combination can enlarge perspectives and improve policy formulation and priority setting.

For a foresight exercise embedded within an agricultural research organization, it is recommended that the objectives are clearly stated, shared within and outside the organization, and approved by a commissioning agency, usually a public decision maker with an interest in the work and who (co-)finances the exercise. This agency should appoint a steering committee responsible for organizing and facilitating the foresight exercise, for choosing methodologies, and for compiling the final recommendations.

The foresight exercise should have a coordinator who activates potential participants, assists in the organization of workshops and seminars, monitors ongoing efforts, and provides information. Experts from a variety of backgrounds should be invited to contribute as members of panels or brainstorming sessions and as writers of essays. These experts should be selected as individuals but represent various communities, including:[31]

- the *research organization* hosting the exercise;
- the *science community* at large, both to ensure that the organization is receptive to new scientific trends and opportunities, and that new research strategies are pursued;
- *consumer interest groups*, since indirectly they will derive most benefit from technological change, and are potentially among the most powerful supporters of investment in agricultural research;
- the *rural development community*, since members of this group are confronted on a daily basis with the constraints to development and poverty alleviation, and may bring fresh perspectives to the key problems that must be addressed;
- the *farming community* – this is one of the most important groups representing the private sector, and the key reference group for most agricultural research. Farmers understand the problems and often have clear ideas about the feasibility of alternative research strategies;
- *agro-industry* – this is the other important group representing the private sector. In the process of agricultural development, farmers are increasingly integrated into the agro-industrial chain, through forward and backward linkages related to farm inputs, but even more to the processing and marketing of agricultural produce;

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30 Rutten (1997).

31 Sperling and Ashby (2001), Janssen *et al.* (2004).

- *the 'public'* – agricultural research must relate to the problems as perceived by the public. Science journalists may contribute by identifying concerns that may be overlooked by experienced researchers; and
- *national, bilateral, and multilateral investment agencies* – agricultural research must be aligned with financial resource flows and agricultural investments so that research is linked to extension and development efforts.

The next three sections present three embedded foresight exercises that have been (co-)organized by research institutes in support of agricultural research and development activities.

4 Possible futures for a commodity: cocoa research priorities

In the 1990s, the cocoa commodity chain went through turbulent times due to accelerating technical, social and economic changes. International agreements aimed at price regulation and policy harmonization were questioned, and a new International Cocoa Agreement had to be negotiated in 1995. New relationships between public research and industry resulted in increasing vertical and horizontal integration within the sector. National research institutions faced many financial and institutional difficulties. New scientific discoveries required new research methodologies.

In this context, in January 1997 the Centre de coopération internationale en recherche agronomique pour le développement (Cirad) launched a cocoa foresight exercise to identify the research questions on which Cirad's researchers should focus, and to help them accept changes in their research priorities. The emphasis was as much on the process as on the results of the exercise.

A knowledge base, key variables and scenarios

A knowledge base covering both science and society was created, organized around four themes. Data sheets were prepared, providing information on current strengths and weaknesses, trends, possible breakthroughs and the potential for change. The data sheets were structured in such a way that would facilitate the identification of variables and trends that might influence future developments. The four themes of the knowledge base were as follows:

- *Countries*. The data sheets described the commodity chain in the producing and consuming countries, in order to assess the present situation, production trends, social needs and opportunities.
- *Actors.* The data sheets described the principal stakeholders – producers, marketing organizations, traders, industry, consumers, researchers, professional associations, international organizations, etc. – in order to assess their roles and attitudes.
- *Cross-cutting themes.* These included quality, prices, legislation, etc., in order to evaluate emerging themes for research.
- *Science.* These data sheets outlined the research results so far, current issues in various fields (genetics, agronomy, plant pathology, economics, etc.), as well as the state of scientific knowledge and the tools currently in use, in order to evaluate the situation of the research community and emerging scientific and technical opportunities.

About 20 Cirad researchers analyzed the knowledge base in brainstorming and group discussions. During the *exploration phase* they listed and discussed potential variables. Some macro-environmental variables were characterized as 'uncontrollable' (e.g. climate, demographic trends, geopolitical shifts, economic growth and development, exchange rates). Other micro-environmental variables, such as market and industry trends, were characterized as 'controllable' by either Cirad or other actors. During the *selection phase* several controllable variables were identified as 'key variables' for the future. These variables were as independent as possible of each other, so that changes in one would not influence the others. The key variables for the cocoa chain were identified as: the balance between production factors (land, labour and capital), parasites and diseases, quality, consumption, and the operators of the commodity chain, especially professional organizations. Once these variables were identified, the researchers were able to prepare scenarios and to identify new questions for research.

The focus was on breakthroughs in order to develop contrasting scenarios that could provide a useful basis for the discussions. First, micro-scenarios were prepared for each of the controllable key variables that were considered to have the greatest influence on the commodity chain. Then, the compatibility of the different micro-scenarios was analyzed and three broad scenarios were prepared: the continuation of current trends ('business as usual'), an 'optimistic' scenario based on the sustainable development of the chain, and a 'pessimistic' scenario that detailed a production crisis and the virtual disappearance of the chain. The objective was not to present the future accurately, but to show extreme situations in order to encourage the participants to react, discuss and decide. Mathematical simulations of the three scenarios were produced using a world food analysis security model.

The participants then analyzed the roles of the many stakeholders in the cocoa chain – public and private producers, producer organizations, national policy makers, traders, industries, research organizations and intergovernmental organizations – and their relationships. This led to the proposal of a new typology for the countries involved in the commodity chain, and to the identification of new functions in the chain.

A collective view of the possible futures for cocoa

The cocoa foresight exercise involved a sequence of collective learning cycles that took place in two processes: through the compilation of the knowledge base and bibliometric studies, and discussions. The knowledge base led to the conversion of impressions into facts. It facilitated the identification of the variables that had influenced past trends and could perhaps affect future developments, leading to a collective and shared representation of the situation. A bibliometric analysis of two internal databases was carried out to assess the strengths and weaknesses of Cirad's cocoa research programme. A retrospective analysis of publications (articles, conference papers, reports, theses, etc.) and missions to partner countries covering ten years of activities was done. The scientists were encouraged to question the reasons for their presence in some countries and their thematic fields of research.

Discussions played an important role in the learning cycle. In a series of meetings, Cirad's researchers started to question their research activities and to wonder whether they were on the right track. They expressed some of their doubts and raised new ones. Slowly, a consensus emerged about a possible optimistic scenario for the commodity system, about changes that should be implemented, and new research activities. Outside experts were consulted on an *ad hoc* basis. For example, when groups of chocolate firms met, the foresight work was

presented to them in order to obtain their feedback and to develop new networks. Operators in the commodity chain made useful comments that led to revisions in some hypotheses and scenarios. Individual contacts were often more constructive than group meetings because in meetings representatives of firms and policy makers would not give clear-cut opinions since they did not wish to reveal their strategies to competitors. Discussions contributed to changing opinions and to the construction of a common language.

New research priorities, partnerships and networks

After the foresight exercise, the collective view of the possible future of cocoa led to several changes within Cirad. Whereas the overall objective of the research programme had been to improve productivity, it would now focus on the sustainable development of cocoa production. This paradigm shift meant that in the future the programme would take into account economic as well as social and ecological aspects in an interdisciplinary approach. This was accepted because the researchers were aware that they had been on the wrong track.

The exercise led to the identification of threats and opportunities within the possible futures, to the definition of a desirable future, and the conditions necessary to reach it. This was a first step towards the establishment of a 'global cocoa programme'. The outcomes of the exercise were presented to stakeholders at a meeting in Paris in March 1999, and in June 2001 the Global Coordination Group on a Sustainable Cocoa Economy was officially launched. The 18 members of the group include representatives of farmers, governments of producing and consuming countries, national research centres in the producing countries, advanced and international research centres, the chocolate industry, and trade associations. Extra funding for research followed the establishment of the group. Linkages were developed between Cirad and the USDA. Since many operators in the cocoa chain were worried about future supply and consumer pressure to be environmentally friendly, they were sensitive to the added value provided by the scenarios so that they were adopted outside before internally within Cirad. All the operators decided to work in the same direction, even though each one might have had a different reason for doing so.

From a closed system into the political arena

Once the scenarios have been designed, the next challenge is to maintain the spirit and attention to outside events, and to continue to evaluate and correct ongoing activities. The foresight exercise may have ended, but the process of keeping database up to date, developing partnerships, keeping abreast of developments and, if necessary, formulating new research projects, continues. The experience of the cocoa foresight exercise shows that anticipation (prospective thought), appropriation (collective mobilization) and action (strategic will) keep up the spirit of thinking about the future, about projects and about networks.

Many research organizations tend to function as 'closed systems',[32] in which the goals are not imposed from the 'outside' and many staff seek to gain personal advantage, especially peer recognition. Before the foresight exercise, Cirad's cocoa programme was a closed system where researchers tended to think they alone were competent to analyze the sector's needs for innovation and to define their research priorities. They feared that the influence of stakeholder groups, especially agro-industrial firms, would limit their scientific creativity and manipulate them as researchers in a public institution. They feared being obliged to serve private

[32] Mintzberg (1983).

interests. Evaluation and foresight pushed the 'closed system' into a 'political arena'. The differences between members of the coordination group – i.e. other stakeholders in the chain – became more apparent. The internal group became more politicized, and more concerned with its role in society. There were complex and reciprocal movements of power between the two coalitions. The foresight became the basis for a new type of discussion. Foresight and evaluation are indispensable instruments for the evolution of research programmes and for research institutions.

5 Possible futures for a country: agriculture in the Netherlands

In the Netherlands, the National Council for Agricultural Research (NRLO) is financed by the Ministry of Agriculture. Its task is to explore social, scientific and technological changes over the next 15-20 years using foresight studies to support strategic management in agricultural research.

Between 1995 and 1999, NRLO conducted a foresight exercise on the challenges facing agribusiness, rural areas and fisheries, and the contribution of S&T to meeting these challenges.[33] Most of the 1000 participants came from knowledge organizations (academia, research institutes, consultancy firms, etc.), national and provincial governments, societal organizations and the private sector. The participants shared a more or less well articulated sense of urgency that 'business as usual' was no longer tenable. Many were convinced that further modernization of farming practices would no longer suffice to make farming sustainable in social, ecological and economic terms.

The foresight process

In terms of content, the NRLO foresight process consisted of three themes. The first two, dynamics in society and dynamics in science and technology, were subjected to foresight. The third theme assessed the strategic consequences of the first two for the organization of innovation processes. Under each of these headings several sub-themes were defined. Most of the science and technology sub-themes were selected because of their expected relevance for coping with societal trends, in addition to their anticipated scientific or technological relevance (see figure 3).

Major themes	**Dynamics in society**	**Dynamics in science and technology**	**Organizing innovation processes**
Sub-themes	Agribusiness: • societal perspectives • globalisation • markets an consumers • agriculture and environment • animal health Rural areas Fisheries and aquaculture	Sensor technology Packaging technologies Veterinary epidemiology Molecular biology (animals and plants) Nanotechnology Production ecology Data processing Aquaculture Policy sciences and ICTs	Innovations at • systems level • large scale • multi-actor

Figure 3. The themes of the NRLO foresight process

[33] Van der Meulen *et al.* (2003).

In the design of the process, the idea was to alternate phases of divergence and convergence. Because dealing with uncertainty and making use of creativity are central, much room was given to generating broad arrays of possibly relevant ideas, insights, facts and strategic options. Selection phases were necessary to redefine the focus, but were again followed by phases of divergence. In most cases the divergence-convergence pattern was repeated two or three times, as illustrated in figure 4.

An additional requirement for the design of the process was to build agendas to give each foresight activity its own dynamics and provide a focus for the next step. Through such agendas, the aim was to ensure the commitment of members of the networks, as well as those who were involved only in the process. Therefore, at each step in the process, agenda-building questions were raised, such as 'what is really at stake?' (e.g. in the fisheries sector); 'what do dynamics in the societal, scientific and technological environment actually mean?' (e.g. for future options in the fisheries sector); 'how can the actors involved respond to those dynamics?' (e.g. what strategic conclusions can/should fisheries organizations and policy makers draw?); and 'how interdependent are individual strategies, and is there scope for collective action?' (e.g. do fishermen's strategies depend on what retailers want?).

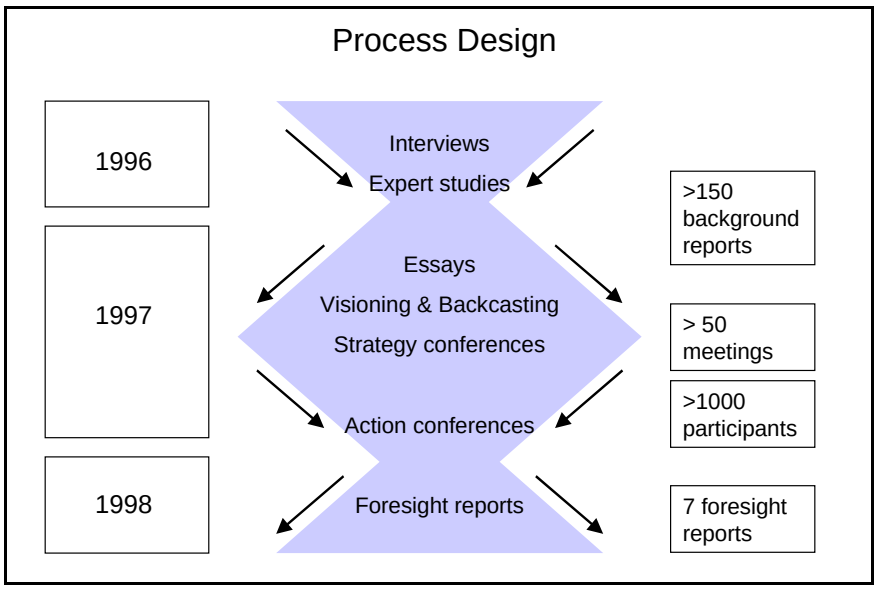

Figure 4. The NRLO foresight process: phases of convergence and divergence.

In the end, ten proposals for action were selected, including efforts to improve learning capacities, programmes for long-term system innovations and network development. These proposals for action were important results of the exercise. If well designed and implemented, the foresight process can encourage strategic, long-term thinking about an entire sector, like agriculture, and trigger decisions by different actors.

6 Possible futures for food, agriculture and the environment: IFPRI's 2020 Vision

In 1993, in collaboration with national and international institutions, IFPRI launched the 2020 Vision for food, agriculture and the environment. At that time there was considerable complacency regarding international food security. World grain stocks were high, and international prices were low, partly as a result of declining external assistance for agricultural development, and for international agricultural research. IFPRI decided to launch the initiative in order to refocus attention on agriculture and to stimulate debate on world food security.

The 2020 Vision initiative has two objectives. First, it aims to develop and promote a shared vision and consensus for action for meeting food needs while reducing poverty and protecting the environment. Second, it hopes to generate information and encourage debate in order to influence action by national governments, NGOs, the private sector, international development agencies and civil society. The initiative was intended for three audiences – researchers, educators and policy makers in the industrialized and developing countries – and is advised by a council of heads of state, Nobel Prize winners, chairmen or directors of donor agencies and researchers.

The process

The 2020 Vision initiative involves four major activities:

- generating information on key topics related to food, agriculture and the environment, paying special attention to emerging issues with long-term implications for world food supplies, alleviating poverty, and protecting natural resources;
- communicating the 2020 Vision challenges and the related action programme in order to increase public awareness of global food and environmental problems and what can be done to resolve them;
- facilitating forums for dialogue, debate, information sharing and consensus building among policy makers, researchers, and leaders in NGOs, the private sector and the media; and
- conducting pilot projects in research, policy communications, and capacity strengthening to support IFPRI's long-term strategy.

Looking back, one can distinguish three phases. Phase I (1993–96) consisted of writing papers and constructing Impact, a new global food model. In the first two years, under the 2020 Vision logo, IFPRI published many discussion papers and policy briefs, and organized 35 meetings to stimulate discussion and debate. In June 1995, at a conference in Washington, DC, attended by 500 people from 50 countries, IFPRI's director-general issued a powerful message that, as the world moves toward 2020, the global food situation might be safe but tremendous human suffering will continue, with hunger and malnutrition in large parts of the world, and rampant natural resource degradation. Although the world's natural resources would be sufficient to relieve this suffering by 2020, political will may be lacking. He argued that relieving this suffering would require, first of all, policies designed to improve the performance of developing country agriculture.

Phase II (1997–2001) saw the improvement of the Impact model, international communication and consensus-building efforts, as well as helping developing countries to

design and implement their strategies at national level. This phase ended with a conference on sustainable food security for all, in Bonn in September 2001. The 900 participants, from the public and private sectors and civil society, discussed the goals, solutions and actions necessary to end hunger in the next two decades, and considered the critical driving forces to achieve food security and priority areas of action at global and national levels.

In phase III (since 2001), more studies were published, and conference, 'Assuring food and nutrition security in Africa by 2020', was held in April 2004. It brought together more than 500 traditional and new actors and stakeholders from more than 50 countries to discuss how to bring about change and action to assure food and nutrition security. A new tone marked the conference: the dramatic situation in Africa was clearly presented; doubts about the capacity of Africa and the world to address the present and future crises were expressed, but at the same time the participants expressed their political will to find solutions rather than to wait for funding from OECD countries. As one participant put it, 'The strength of the conference was the mixture of delegates from political, academic, administrative and activist backgrounds, which enhanced the quality of the debate. Its weakness was in the broad spectrum of issues covered, and hence the inability to go into any issue in any real depth'. A statement on the way forward shows that the conference is part of a longer-term consultative process on real action toward food and nutrition security in Africa. The steps forward must focus on implementing action and on developing a process of learning and change. Specific 'road maps' for change must be developed at regional and national levels, building on existing strategies where appropriate, and facilitated by an organic process.

Impact assessment

In 1999, an external impact assessment of the 2020 Vision initiative[34] evaluated the capacity of the initiative to reach the three audiences, to achieve consensus, and to catalyze action. Although the initiative had reached a large number of researchers and educators within universities, research organizations, international financial institutions, private companies, think thanks and NGOs, it had not managed to generate consensus among researchers (e.g. about research priorities) and had therefore had little impact on them, or on developing country policy makers, probably because the objectives were too broad.

7 Foresight for Africa

Over the last 50 years agronomic research has helped to transform French agriculture. After the Second World War, France was not self-sufficient in food, even though more than one-third of the population worked in agriculture. Today, France is the world's second largest exporter of agricultural produce and agro-food products. Three factors have contributed to this success: the development of public policies with substantial budgets for their implementation; the emergence of a social movement within the agricultural sector that developed and encouraged modernization; and the creation of a dynamic public research system, strongly supported by development and training institutes.[35]

Over the last five years, the European Commission and EU Member States have worked to develop, through foresight, the policy and research capacities in the ten new Member States,

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34 Paarlberg (1999).

35 Hervieu (2001).

and to assist their integration. In the developing countries, especially in Africa, despite even greater challenges, foresight could be used to identify agricultural research objectives. The drivers are there: African agriculture is among the world's most globalized and at the same time the most subsistence-oriented;[36] it relies on exports of unprocessed agricultural commodities; and it produces part of its food requirements and imports the rest. In view of the enormous agro-ecological, economic and sociological diversity and complexity a systems approach is essential. The number and the diversity of actors are increasing – producers and producer organizations, national and international companies, NGOs, public enterprises, universities, research institutions, etc. The relationships between research and trade policies are developing due to international agreements and developed country policies. There are also risks: despite international efforts, policies for agricultural research and development are inadequate, and the state of S&T has deteriorated substantially in most African countries. National educational and research coordinating bodies have lost much of their political power and influence – there was virtually no recruitment throughout the 1990s and salaries are inadequate. Despite the lack of institutions and of political commitment, foresight could help foster commitment to the future and encourage debates among actors.

In public institutions, researchers from different disciplines have learned to work together and to develop multidisciplinary research projects. They have also adapted their methods of work to local conditions and are increasingly working with farmers (participatory methods) to identify demands and to develop producer organizations. More work must be done for researchers to work with the rest of civil society, especially consumers and politicians. Cooperation between researchers from public organizations and in the few private companies interested in Africa could also be increased. Foresight could help this movement.

Foresight is not a panacea. It is a time-consuming process, but it can help in discussions about complex systems and in the formulation of demands. It forces the participants to be inventive, to make linkages among variables, and to take appropriate decisions. Striking a balance between global analysis and strategies for a commodity on the one hand, while remaining practical and specific, and using the results to reorientate policies and research programmes on the other, is not easy.

Experience indicates that it is important to maintain a balance between pressures from the inside (research staff) and the outside (stakeholders, especially the 'powerful' ones, such as agro-industrial firms) and to acknowledge weaknesses, but at the same time to be reasonably ambitious. Foresight should be seen as a contribution to a global effort, and stakeholders should be explicitly informed that the final choice of strategic options will be made by the decision makers.

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[36] Von Braun (2004).

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Useful websites related to foresight and agriculture
(in English and French)

European Commission, DG Research: www.cordis.lu/foresight/home.html
European Commission, Institute for Prospective Technological Studies: www.jrc.es/welcome.html
European Science and Technology Observatory (ESTO): http://esto.jrc.es/
Futures Research Centre, Finland: www.tukkk.fi/tutu/default_eng.asp
Futuris: www.operation-futuris.org/dyn_menu.asp
Global Business Network (GBN): www.gbn.org
Groupe Futuribles: www.futuribles.com
Groupe prospective du Sénat, France: www.prospective.org/
Institut National de la Recherche Agronomique (INRA): www.inra.fr/sed/prospective/index.html
Institute for Alternative Futures: www.altfutures.com
International Assessment of Agricultural Science and Technology for Development (IAASTD): www.agassessment.org/
International Food Policy Research Institute (IFPRI): www.ifpri.org
Millennium Ecosystem Assessment: www.millenniumassessment.org/en/index.aspx
National Council for Agricultural Research (NRLO), the Netherlands: www.agro.nl/nrlo/english/nrint2pg.shtml
OECD International Futures Programme: www.oecd.org/department/0,2688,en_2649_33707_1_1_1_1_1,00.html
Policy Research in Engineering, Science and Technology (PREST), University of Manchester: www.les1.man.ac.uk/PREST
Rand Corporation: www.rand.org
Technology Foresight (2002 collection), UK: www.foresight.gov.uk
World Future Society: www.wfs.org