*Technology Analysis & Strategic Management*
Vol. 20, No. 3, May 2008, 271–285

Routledge
Taylor & Francis Group

# 'The Navigator Network': a New Zealand futurewatch case study

Jane Cameron[a]*, Barbara Nicholas[b], Katherine Silvester[c] and Karen Cronin[d]

[a]*Ministry of Research, Science and Technology;* [b]*The Navigator Network;* [c]*Ministry of Research, Science and Technology;* [d]*The Navigator Network*

New Zealand's 'Navigator Network' is a national scanning network of scientists and policy analysts providing 'early alert' advice about emerging areas of science and technology. It was established by the Ministry of Research, Science and Technology (MoRST) to enhance the government's readiness to respond to the opportunities and risks around new technologies, particularly in biotechnology and nanotechnology. The Navigator Network has been tailored to the New Zealand context, which is characterised by a small, well-connected government sector and a strong focus on agricultural biotechnology and food. The network builds on these features, and is 'people-centric' rather than 'information-centric', using dialogic approaches to generate new knowledge between diverse stakeholder groups. It also focuses on building futures capability in the government and science sectors. Representatives from government agencies are integrated into the process as scanners to facilitate uptake. It also has an adaptive development process via an action learning component.

**Keywords:** New Zealand; public sector; futurewatch; environmental scanning; biotechnology; nanotechnology

## 1. Background

The Ministry of Research, Science and Technology's (MoRST) futures work programme arose in large part from the deliberations of a Royal Commission on Genetic Modification (RCGM). The RCGM was established by the Government in May 2000 to look into and report on the issues surrounding genetic modification in New Zealand. In its July 2001 report, the RCGM made a total of 49 recommendations about genetic modification (GM) and its regulation in New Zealand.

The RCGM's key message was to preserve opportunities while keeping options open for the future. The Commission concluded that it would be 'unwise to turn our back against the potential advantages on offer', but at the same time we needed to 'proceed carefully, minimising and managing risks' (Royal Commission on Genetic Modification 2001). It therefore recommended that New Zealand develop a capability for what it called 'biotechnology futurewatch'. This was confirmed by the government in 'The New Zealand Biotechnology Strategy' (May 2003), which is being implemented through MoRST.

*Corresponding author. Email: jane.cameron@morst.govt.nz

ISSN 0953-7325 print/ISSN 1465-3990 online

DOI: 10.1080/09537320801999538
http://www.informaworld.com

In this context, the futurewatch programme is described as follows:

> Futurewatch activities scan, analyse and disseminate information on emerging developments to provide early alerts of new opportunities and issues. There is a need to strengthen futurewatch capacity to enable better and earlier identification of emerging biotechnologies that should be discussed by New Zealanders…It will also improve the Government's capability to respond to new biotechnologies in the New Zealand context, including biotechnologies that link with other technological developments such as nanotechnology. (New Zealand MoRST 2003)

The objective of the futurewatch programme is to strengthen ways for New Zealand to foresee and make timely responses to emerging issues and opportunities relevant to biotechnology. It reflects the overarching theme of the biotechnology strategy which is 'development with care'. The strategy is divided into three key streams:

- *Growing the sector*: Grow New Zealand's biotechnology sector to enhance economic and community benefits;
- *Regulation*: Manage the development and introduction of new biotechnologies with a regulatory system that provides robust safeguards and allows innovation; and
- *Community*: Build understanding about biotechnology and constructive engagement between people in the community and the biotechnology sector.

This strategic approach recognises the need to balance both the opportunities and risks that biotechnologies may present for New Zealand and establishes the policy context for the biotechnology futurewatch initiative. The Navigator Network is the key component of MoRST's futurewatch programme and is the focus of this paper.

The Navigator Network also reflects new approaches to innovation systems governance particularly in the use of horizontally enabled, networked information and learning systems (OECD, 2005; Hajer and Wagenaar 2003; Rowe and Frewer 2005). Futurewatch is also as example of more 'open' styles of governance for science and technology. These incorporate more participatory, inclusive approaches with multiple stakeholder and societal groups. The inclusion of a futurewatch component as part of the mandate of Toi te Taiao: the New Zealand Bioethics Council as an input to foster dialogue on the cultural, ethical and spiritual aspects of biotechnology is reflective of this.

MoRST's use of the term 'futurewatch' is synonymous with 'environmental scanning' or 'horizon scanning' (Glenn and Gordon 2003). It involves: (1) scanning and monitoring, i.e. looking for 'new' things that might require a policy alert; and (2) analysis, i.e. considering the significance of the scanning reports for New Zealand. Essentially, futurewatch is about thinking ahead. It is not about predicting what will happen but about identifying issues that may or may not need to be addressed. Futurewatch can therefore be seen as an orientation to future trends and developments which involves:

- looking out to the edge – identifying potentially important things at the margins of current trends and thinking, including early signals of new or 'leftfield' developments;
- reading the horizon in an open way – bringing in a range of perspectives, considering uncertainties as well as certainties, being mindful of assumptions, imagining different possible futures, and leaving room for creativity; and
- considering the big picture – this includes interactions in whole systems, thinking about risks as well as opportunities, and considering wider time horizons (history as well as future).

## 2. International comparisons

The design of this programme draws on a number of comparative international government initiatives which have a basis in environmental or horizon scanning. Many of these programmes have emerged from a 'risk paradigm' in an attempt to establish more effective early warning systems, notably as a response to animal health-related and agricultural sector crises, like the emergence of foot and mouth disease or BSE. Particular examples in this context include, the UK Department of Environment, Food and Rural Affairs' (Defra) Horizon Scanning and Futures programme, and the US Department of Agriculture's (USDA) Center for Emerging Issues which tracks and monitors emerging animal health issues.[1]

MoRST's futurewatch programme has also been influenced by science and technology policy-driven horizon scanning initiatives, such as the Horizon Scanning Centre of Excellence at the UK Office of Science and Innovation (OSI).[2] The New Zealand futurewatch initiative shares a number of similarities with OSI's horizon scanning centre, including the subject focus and methodology, as well as the aim of supporting departmental activities and facilitating cross-departmental collaboration. This cross-departmental collaboration includes the provision of tools and support to spread best practice and to facilitate capacity-building.

This initiative also has process features in common with an Australasian initiative: The Australasian Joint Agency Scanning Network (AJASN). The AJASN is an environmental scanning group consisting of members from a number of Australian and New Zealand government agencies drawn largely from the environmental management sector. Participant organisations all contribute scans to a mutual database. Scans are discussed at quarterly meetings, facilitated by an independent futures consultant[3] during which issues and trends are identified. These issues and trends are then written as articles by members and presented as quarterly and annual Horizon Watch reports.

Engaging with other agencies has resulted in a synergistic effect for the AJASN by including people with a range of experience, and exposure to different information. This results in all member agencies having access to strategic information that would be otherwise precluded from their knowledge bases. A range of points of views reduces the risks of subjective interpretations of data. It is also an opportunity to forge strategic relationships across organisations and to increase information flow between government departments.[4]

## 3. Implementing the 'futurewatch' programme

The implementation of MoRST's futurewatch programme began in 2003–2004 with the establishment of an internal capability in environmental scanning. A broad scan of global trends in biotechnology was completed and published in January 2005 (New Zealand MoRST 2005). This was primarily intended for use by New Zealand government agencies, but it has had a broader impact and is now contributing to international initiatives such as the OECD's current 'Bioeconomy to 2030' project (OECD 2006). This first report focused on emerging biotechnology developments for health, primary production, industrial, environmental, defence and security applications. The trends were presented with reference to their social and business context. The report was intended to provide a baseline scan against which emerging biotechnology trends and developments can be compared.

In the second phase of the programme implementation, MoRST set out to establish an ongoing scanning capacity and to achieve this through a network of interests and skills. The intention was to bring in a wider range of people and organisations and extend the scope of interest beyond biotechnology to other emerging science and technologies, notably nanotechnology. In New Zealand the

scanning of emerging science and technology is carried out by a range of people and organisations in the public and private sectors in an *ad hoc* fashion depending on the needs and strategic orientation of the agency concerned.

The development of a scanning network was seen as an operational solution that would draw on these existing skills and networks in a coordinated and efficient way to provide 'early alerts' on emerging science issues. It was also intended to promote relationships that will result in better quality linkages between science and policy.

The primary end-user of the network's findings is a core group of New Zealand government agencies with an interest in biotechnology and nanotechnology policy. The network reports are intended to provide input to a wide range of policy and operations across government. This includes science policy, economic development, regulatory settings and public engagement.

The central government sector in New Zealand is small, with most departments in close proximity to each other. Despite the relative ease of communication, there is an emphasis in current policy on strengthening the horizontal connections between departments and portfolios. This *whole-of-government* approach includes a range of inter-departmental officials groups working on complex multi-faceted issues. Emerging technologies such as bio and nanotechnology are highly relevant in this context. They are broad fields of technology that are developing rapidly. Both are surrounded by uncertainty (about events, scale and the pace and consequences of change). These technologies tend to generate a range of perspectives about what is possible or desirable, and carry high stakes in economic, social and environmental terms.

Maintaining connections between the government and science sectors are equally important. This is especially relevant in New Zealand where science capacity is predominantly in public-owned research institutes and universities and, compared with other countries, there is limited capacity in central government. The relatively small size of both the government and science sectors means that there are significant opportunities to lever off existing networks to build linkages in a smart, cost-effective way.

MoRST's objectives for the development and design of a distributed scanning network were therefore to:

(1) Support discussion and a collective understanding of new and emerging science and technologies, how they may influence New Zealand's future, and what actions may be required to address their challenges and opportunities.
(2) Gather, synthesise and share information and support linkages in the exchange and convergence of ideas between the policy and science communities.
(3) Support the development of a culture of early thinking across government and more broadly.
(4) Develop, apply and profile a New Zealand approach to environmental scanning.

It was decided to contract the scanning network activity to independent researchers or consultants, to provide a distance from the political activity and immediate policy demands in central government, and enhance the potential for independent advice which could challenge existing institutional knowledge, world-views and horizons.

MoRST looked for contractors who could provide project management, co-ordination and intellectual leadership for the design, implementation and maintenance of the network. They envisaged that this team would work with MoRST staff to contribute knowledge of best practice scanning and futures thinking, build on the findings of the 2005 baseline scanning report, and provide support with communication and uptake of findings across government. The successful contractors were a team with experience in policy, futurewatch, bioethics, public dialogue on

science, risk analysis and project management. Both members of the team brought extensive links into the research community.

## 4. The Navigator Network

The scanning network was formally launched in November 2005 under the brand name of 'The Navigator Network'. This title was chosen to reflect the emphasis on scanning the horizon for future developments in science and technology, and to echo the foresight of those first navigators who historically made their way to New Zealand across the seas from different parts of the world. It was also designed to suggest that there is not a single, predetermined future pathway: rather, that strategic direction results from a process of reading signals on the horizon and making adjustments along the way. This is inherently a social as well as a technical process.

This initiative is largely oriented towards achieving 'soft' rather than 'hard' policy outcomes, i.e. developing discussion and linkages between the policy and science communities, focusing attention in the policy sector towards a futures horizon, and building capacity in futures thinking. There is an expectation that this will lead to more considered policy advice and strategic planning in the public sector, which recognises the crucial role that new science and technology will play in New Zealand's development.

The Navigator Network project is therefore geared towards creating knowledge through social processes rather than harder-edged techniques like scientometric data-mining. The process of scanning and developing insights then becomes a vehicle for knowledge sharing and creation. The project team set out to create a national network predicated on engagement with diverse forms of expertise and multiple communities of practice. The rationale was that unexpected or unseen patterns were more likely to become visible if people contributed from different domains and world-views. Fresh questions may not emerge so readily from within any one field of thinking.

This approach involves more than the collection and reporting of trend data. It requires access to a broad range of information, and uses a mix of frameworks or analytical lenses through which to 'read' the trends in their wider context, and to interpret their possible significance. Drawing on a mix of specialist knowledge, the Navigator Network employs social processes, such as facilitated workshops, through which new knowledge can be constructed and analysed.

The design of the project has been influenced in the first instance by soft systems methodology (Checkland 1981). Close attention has subsequently been paid to how the various network components are connected to and relate to one another in the context of producing knowledge. This bears in mind end-user organisations, the various contributors and the ways they engage together, the social and political context within which the activity takes place and the ultimate owner of the project, MoRST's needs.

The Navigator Network also draws on recent thinking around dialogue (Bohm 1996; Chasin and Herzog 1996; Cronin and Jackson 2004; Anderson and Baxter 2004), and the potential for enquiry of the 'other' to widen the scope of inquiry and create new possibilities. The scanning process was therefore designed in three stages: collection of data by scanners, group reflection on its significance and the connections between the scanning reports, followed by analysis and reporting to the end-user group.

The designers recognised that in order for this approach to be successful the project required:

- The participation of representatives from key scientific and technical disciplines, industry representatives, plus other expertise in social and cultural disciplines and policy;

- Processes to identify new developments inside mainstream science and business sectors, and at the margins of awareness; as well as
- The design of a setting within which this information could be further explored, both by scientists and those who offer additional expertise.

Initial activity revolved around creating awareness of the network to build participation. The Navigator Network team invested considerable effort in building relationships with key organisations and individuals; and a web site was created (www.navigatornetwork.net.nz) where anyone with an interest in science futures could join as a member of the Navigator Network and receive ongoing reports on the project.

A number of elements specific to the New Zealand context supported this approach. This includes the advantages of being a small country where people are well connected across sectors, a research community with considerable expertise in biological sciences and where scientists are practised in engaging with other sectors, and experience in dialogic processes encouraging enquiry rather than advocacy.

The early recognition that the project was designing a 'system' from which knowledge would be created meant that the Navigator Network team was committed to on-going active reflection on the project design and evolving methodology. Like much futures work this project was influenced by various traditions in action-research (Ramon 2005). In this case our questioning and inquiry was influenced by the reflective practitioner (Schon 1983), appreciative inquiry (Cooperrider 2004), community research and organisational learning (Senge 1990) and participatory and critical research (Kemmis and McTaggart 1998).

Reflective practitioner theory recognises that there is no straight line between theoretical knowledge derived in a discipline and the application of it. It is not sufficient to look at direct application of knowledge but one also needs to make inter-disciplinary links and links to social and political contexts.

Appreciative inquiry is a form of action research that takes seriously that inquiry *in itself* creates a frame and is thus determinative. It is therefore useful to create a frame that directs the inquiry to the outcomes sought. Typically, this is done by *appreciative* inquiry – to highlight by inquiry aspects of a system that have proved beneficial or functional. In this case because the focus was futures, both the framing of the scanning reports and the way people were invited to engage with the results of scanning were designed to highlight possible futures and were not simply seeking logical extensions within the discipline of the participants.

Participatory and critical action research traditions draw attention to the significance of power relations and the social situated-ness of participants to sustain or disrupt power relations and patterns of thinking. A knowledge-making community was deliberately constructed to disrupt settled patterns of thinking by ensuring the new voices were drawn into the conversations – both through the introduction of people from scientific disciplines not initially well represented, or by invitation to the workshops of people from varying communities of knowledge. Social processes were then designed which created opportunities for them to contribute their different questions and knowledge.

All these traditions of thinking and action research informed the design of the project, and also the interactive methods used in workshops. Underlying all this was an assumption of continuous change throughout the process, with the key focus being on learning that would happen at the conceptual and organisational levels of the project.

Taking this approach has embedded a degree of flexibility into what was always going to be an evolutionary design. As a consequence, the process has been refocused over the 2-year life

of the pilot project, notably through refining the scanning reports and trying new methods in the workshops to engage the wide range of participants involved. There have also been pragmatic learnings, such as the practicalities of sustaining a skilled scanning team over time. MoRST and the contractors have also clarified, in a step-wise fashion, the nature and form of the outputs that will achieve the client's purposes.

The project is using three scanning methods to generate information. In the first, a core group of 20 scanners around the country provides four monthly reports of 15–20 observations. In the second, the project has commissioned an in-depth scan to explore trends and issues in one important field: neuroscience. In a third component, a symposium is being planned to consider the global context and the key environmental, social and political trends affecting New Zealand's future prospects in food production – and the implications of that changing context for science and research.

### *Model one: the core process – scanning the broad field of biotechnology and nanotechnology*

The core scanning activity involves a regular cycle of scanning reports, a workshop and a report to government. The scanning reports are a set of expert observations provided by science scanners commissioned by the project along with scans from policy analysts in government. This data set is brought together for the whole scanning group to consider in a facilitated workshop, along with the end users. The workshops are an opportunity to interpret or 'make-meaning' of the diverse reports. The final report summarises the results of each cycle and includes commentary from the Navigator Network consultants running the project. This report is then distributed widely through MoRST to the end user group, and to the wider network membership and the news media. It is a resource document for sharing the scanning reports more widely and reflecting on the findings in the New Zealand context.

The core group of scanners was recruited from the science and social science community, including public and private sector experts. The project team signalled that it was looking for 'restless thinkers', people who were interested in futures thinking and the opportunities to network with a wider circle of contributors. It includes scanners from a range of research institutions, and across the spectrum of biotechnology and nanotechnology fields. In addition, key government ministries have contributed to the scanning and participated in the workshops.

The front-end of the scanning process involves the contracted scanners filing quarterly reports of observations from their respective expert areas. These are woven together into a draft report synthesising the emerging issues, trends and themes and presenting the breadth of observations

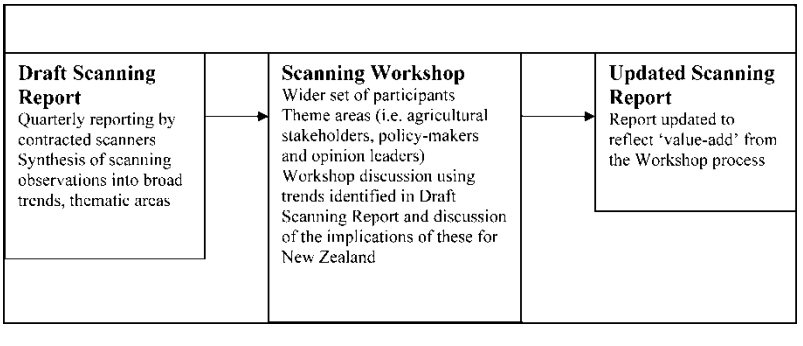


Figure 1. Model One: scanning reporting cycle.

tracked over time. A workshop is then held to discuss these findings, bringing together the scanning team with invited guests from a wider set of organisations to explore the future implications for New Zealand. The final scanning report is then prepared, incorporating the insights from the workshop.

Throughout the process there has been an emphasis on training. As one of the objectives of the Navigator Network is to build futures capability across the science and government sectors it has been necessary to spend time training and developing the skills of the scanners. While the scanners were selected on the basis of their aptitude for futures thinking, very few had used specific futurewatch methods. The emphasis on training has resulted in more robust reporting over time as the scanners have learnt what is most useful to the end users, including the ability to attribute reliable sources and to identify trends that are 'truly new' rather than just 'new to me'. This in turn is resulting in a more 'trusted' product and greater value for the participants and end-users alike.

Subsequent workshops have trialled various interactive approaches to analysing the scanning material. Additional people have been invited to focus on certain themes – for example people working in the agriculture and horticulture sector added considerable depth to the groups understanding of the context for science in New Zealand including the uptake and demands for biotechnologies.

While this model is the main activity, the project is also trialling two additional methods to implement a people-centred approach to futurewatch.

### *Model two: in-depth scan of a particular field of science*

Where the first model scans and tracks a broad spectrum of science developments in biotechnology and nanotechnology the second model involves a detailed focus on a sub-section of scientific endeavour: neuroscience.

As the project was being framed up, it became clear that neuroscience was a fast moving area with significant dimensions of convergence with biotechnology and nanotechnology, and one that we were unlikely to capture adequately with one or two scanners in our core group. Rather than regular scans and workshops, it was decided to explore this area by commissioning an in-depth report and holding a one-off national experts' workshop. This will draw together three levels of consideration – the science, the sector (those with direct interests in neuroscience and

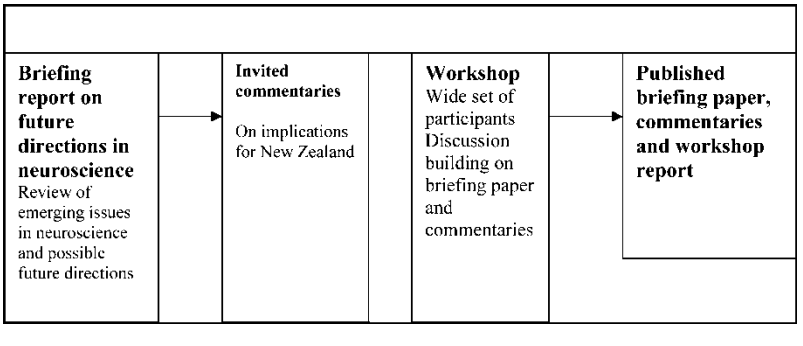


Figure 2. Model Two: scanning an area of science.

its application) and the context (those additional sectors that may be affected by the science and the wider socio-political environment).

A briefing paper was prepared by an international neuroscience expert[5] on future directions and issues in neuroscience as it may develop over a 20-year time horizon. In addition, five New Zealanders were invited to prepare commentaries– two scientists, an ethicist, a sociologist and a lawyer.

All these papers were available online to the wider Navigator Network and prior to the one-day national workshop in March 2007. The workshop involved a mix of invited researchers (with various interests in neuroscience theory and application), policy analysts, social scientists and commentators/advisors. Titled '*Unfolding the Mind: prospects and perils in neuroscience*', the aim of the workshop was to identify the social, political, legal and ethical issues raised by some of the developments in neuroscience, and explore their social and policy implications for New Zealand.

### *Model Three: starting with the context*

An early assumption of this project was that the first place to scan was in the new theories and applications in science that may lead to significant developments. This would then lead onto the implications for new technologies and their adoption in different economic sectors, and the wider social and political context. However, our early conversations alerted us to an alternative trajectory. For example, industry representatives were not starting with the science and seeing what market they could identify, but starting with their understanding of their sector (e.g. agriculture) and identifying their needs for new technology applications. Only then were they turning to the science to see what knowledge or methods might be coming on stream that could provide useful solutions. In other words in many instances aspects of the economic and social context drive the development of science. In addition, especially in the area of agriculture and horticulture (major components of the New Zealand economy) it was clear that many people are aware of major social, economic and environmental issues on the horizon that will impact across many sectors, and which require longer term futures-oriented thinking.

Key trends such as climate change, shifting global access to water and oil, changing geopolitics and demographics will all clearly shape what food is grown where, by whom, and for what markets in the future. Biotechnology and nanotechnology might offer some exciting tools and advances, but the lead-in time from laboratory to market can easily be a decade, and in that time the world could change significantly. Deciding what contribution biotechnology and nanotechnology can make to a sustainable future requires attention to the context within which they might be used and a long-term view of the opportunities and risks.

The Navigator Network is therefore developing a third model of futurewatch, aimed at scanning the global horizon for key trends and influences and exploring what this will mean for key sectors of the economy – and the implications this may raise for future science and technology priorities.

### *Learning to date*

The action-research component of this project has largely been focused on refining the practice of the method/approach to scanning. A simple reporting template was developed that asked scanners to describe the science trend or emerging issue, its source (peer reviewed, professional judgement, etc.), why it was significant, and what were the possible implications for New Zealand?

With time it became clear that we needed to provide for two different levels of reporting:

(1) Early and tentative signals of change, breakthroughs or accelerations in the emergence of new technologies across a wide field; and
(2) More in-depth reports on a trend or development in knowledge. These reports provide more information on the social and/or scientific context for a shift in science or technology, and are prepared more as a mini-briefing on an area of change.

This has been possible in the later stages of the project as the scanners have developed their abilities to identify areas of emerging significance. Both types of reports have value. One provides for the reporting on shifts that do not require a huge level of context, for example, technological developments that will potentially lead to a change in speed of processing. The other provides a richer context for the reader, and space to identify the connections between developments which may not be immediately obvious to the non-expert.

It is one thing to collect the scanning reports. It is another to interpret their significance for New Zealand. We are mindful of a number of 'selection' or 'filter' processes that operate at different points in the process, and the potential for each to influence what is identified as important. The scanners themselves view the world through their own filters and decide what is important to report or not. This is shaped by their professional work, but also their view of where their work 'fits' in the world, and what the users of their reports are likely to value. However, the main opportunity for interpretation was during the workshops. The critical things here have been:

- the social processes used to facilitate discussion and structure reflection
- the need to ensure the conversations are focused on the needs of the end-user, for example, what are the emerging issues in biotechnology and nanotechnology that should be brought to the attention of government?
- the mix of people invited to contribute.

Inviting people from different sectors has been very positive, and added greatly to the understanding of the context within which biotechnology and nanotechnology will have an impact. However, as our guests have been different on each occasion, it has also been important to manage their expectations of the Navigator Network, and to assist them to think in a '20 plus' year timeframe. We are now moving to a more reflective workshop design that can produce an effective discussion with a diverse group, but also actively encourage valuable unexpected insights to emerge.

### *Facilitating uptake of network reporting*

A number of different design features have been employed in the development of the Navigator Network to facilitate the uptake of reporting into policy development. These include the explicit integration of officials in the scanning process as both scanners and meaning makers; utilising existing cross-government networks to take up the scanning observations; working actively with officials to tailor the process to meet their needs; and the active identification of issues by MoRST for more in-depth exploration.

To ensure that the results are taken-up by government departments, the project design included the integration of government officials into three aspects of the process:

(1) A MoRST official with futures expertise became a member of the project team to advise on scanning 'best practice' and to act as a bridge and provide advice on 'what works' from a government perspective;
(2) Officials in other participating government agencies were recruited as scanners – feeding their own scanning observations into the reporting cycles and thus capturing the 'policy context'.
(3) Government agencies also participate as interpreters – more senior officials attending the workshop sessions offer their own insights into future implications of emerging technology developments for New Zealand.

Departmental scanners are distinct from the core group of contracted scanners and are therefore under no obligation to submit reports. To date contributions have been most forthcoming from agencies that have an existing cross-government reporting role (for example, the offshore posts of the New Zealand Ministry of Foreign Affairs and Trade) or those that have an explicit futurewatch role (for example, Toi te Taiao – The Bioethics Council).

MoRST refers the Navigator Network reports wherever possible into relevant existing networks and channels; for example providing briefings to a quarterly cross-government Science and Technology Officials Group on the emerging trends and issues identified by the network. This will hopefully ensure over time that the reporting of the network and broad discussions of future issues will become 'business as usual' to this diverse group of officials.

A cross-government network of 'future practitioners', convened by the State Services Commission, is another forum with interest in the process of futurewatch. While not the core audience of the network, this is a secondary channel that has a practical interest in sharing learning about government-based futures initiatives.

One of the fundamental challenges of reporting on a broad range of emerging science and technology and contextual trends is to identify those areas that may require follow-up policy work by government. To facilitate uptake of the network's reporting, MoRST has worked with end-users to devise a front-end 'filter' to narrow down the issues that are of particular interest to agencies. The most important variables in this 'filter' are:

- a large change in a trend/development: (represented by speed and or scale of change)
- an increased social/political interest or awareness (from a global or domestic perspective)
- the potential for wide cross-sector or cross-government applicability (current or future) which indicates a need for coordinated activity.

MoRST also has an important role in responding to issues identified by the Navigator Network and providing further analysis from a policy perspective. This is achieved in two ways:

(1) By undertaking further work on least one emerging issue for more in-depth analysis annually; and
(2) By organising 'issues forums' for experts to give in-depth presentations to officials on areas of emerging science and technology which will have potential implications for New Zealand.

Where possible, MoRST also takes the opportunity to repackage the trends and issues identified by the network into presentations for other audiences.

## 5. Challenges

As with any futures exercise, implementing the Navigator Network project has not been without challenges. A key issue has been the resource and time intensity of adopting a 'people-centric' approach, and the effort required to build and sustain capability with the turn-over of scanning participants. Another challenge has been relating the reports to multiple policy audiences. Different officials have different analytical styles and functional responsibilities, and varying expectations around the methods used in the workshops for 'meaning-making' of the observations and the form of the final reports.

This approach to futurewatch can only be effective if the right mix and calibre of people is involved. Finding those people, and maintaining their energy and motivation, has taken more resources than originally anticipated. The initial call for nominations was very successful, but in part this was due to the networking behind the scenes in institutions and with known experts. As the process has developed it has also been important to actively seek out individuals with required expertise and coach them into the position.

The team has also had to build their own knowledge of the science and related sectors to be alert to areas critical to New Zealand's future, but not initially represented in the scanning mix. Locating the right expertise takes time and relies on building new relationships in diverse areas of the research community.

There has been a significant turn-over in the group of contracted science and social science scanners. This has frequently resulted from changing work circumstances, but it also became clear that our initial 'mix' of scanners was not optimal, and there was a need to bring in some new skills. Participation from the government sector also changed over time due to staff turnover, but also, as departments developed a more settled position about what level of seniority should be involved in the project.

There has therefore been a need to continually incorporate and induct new people into the process, and develop their skills as scanners. The initial method was one-on-one meetings, but more recently we have changed the workshops to include an induction and professional development component. This has been integrated as an action–reflection component that has also served to develop the competencies of the current scanners.

An important dimension of the project has been ensuring realistic expectations. The Navigator Network is a 2-year project. While it has achieved a number of key outcomes in this short period, the wider value of the process may only become apparent over a longer operating cycle. Some of the science scanners have been aware of the opportunity to highlight particular research trends and priorities. However, the project is not oriented towards setting specific research targets. There are also different expectations within the policy sector, with some focused on operational and regulatory processes and others on strategic and longer-term implications. These various responses reflect the focus points identified earlier, i.e. the science itself, applied science and technology, market applications and the social/political/environmental context in which science is done.

The challenge of the Navigator Network, so far, has been to acknowledge and respond to these factors while retaining the interest and support of all participants by producing outcomes that are seen as valuable and relevant.

Given that the futures interest in biotechnology operates at different levels within government – immediate interest in biotechnology issues, and higher-level strategic thinking about futures in general – it has also been a challenge for the contractors and for MoRST to decide what level of analysis is appropriate for the network reports, and at what level one is seeking to influence end-users. The end-users in government are agencies with responsibilities directly related to biotechnology for example: food safety, environmental and the regulation of

new organisms, agriculture, health and industry development; as well as MoRST's own particular responsibility for research, science and technology (RS&T). Some agencies have limited interest in the process of futurewatch and are more connected to the operational implementation of bio- or nanotechnology policy. They tend to focus on the need for robust levels of evidence in the scanning observations; and prefer a more pragmatic analysis of the reports to 'meaning-making' processes to extrapolate the future implications of science and technology trends.

Other officials are working more directly on futures issues or on higher level sector strategy for health, economic or social policy. This group is interested in a wider set of questions concerned not only with where the science and technology is moving, but also with the frameworks and worldviews within which our current questions are asked and information is interpreted. They also have greater interest in possible future discontinuities in the context of science and technology, such as major shifts in government thinking, or global and national pressures such as climate change, or access to energy and water. These end-users have a stronger interest in the process of futurewatch; tend to be more comfortable with more abstract, exploratory approaches to interpretation; and are less concerned with explicit levels of evidence than in the significance of the trends that may be signalled.

Both sets of needs are important. The network's challenge is to find ways to achieve appropriate levels of 'robustness' in reporting and interpretation which connect with different styles. This may require trade-offs to be made. Reporting needs to meet 'best practice' in scanning while at the same time ensuring that weaker, more emergent signals of change are picked up from mainstream and more speculative sources. Similarly, a degree of 'discomfort' in interpretive, meaning-making processes is useful to get people to move outside their own world views and test their assumptions.

## 6. Positive impacts to date

Although the Navigator Network has only been in existence since mid 2005, it is already possible to identify a range of positive impacts.[6] While there has been no formal evaluation to date, positive impacts can already be detected in terms of learning effects and network building. Anecdotal evidence and new work streams also suggest that network reports are contributing input to strategic policy processes.

The most measurable impacts to date have been in building a national community of interest around science and technology futures. This encompasses not only the core group of scanners and policy-makers, but a broader network of people who participate in the communications and reporting of the Navigator Network. This has been achieved through the concerted networking efforts of the project team and through people registering their interest on the project website. It currently stands at 141 members.

The project has also generated stronger linkages between policy-makers and scientists. This has been evident in the improved connectivity of other government departments who do not usually have strong links with the science community. For MoRST it has opened additional channels into research organisations, and facilitated science and policy connections in topical areas such as biofuel development.

The learning outcomes for scanners and policy-makers have included:

- building futures scanning capability and the subsequent stimulation of scanners to take leadership within their own communities and organisations;
- adoption of futurewatch practices adding value to the strategic direction of a science programme in the organisation of one of the scanners;

- stimulation of futurewatch activity in other institutions (research and government) via the adaptation of the Navigator approach in strategic processes (which in turn feedback into the network's reporting); and
- the collective learning at the Navigator Network workshops drawing on the reports and the multiple perspectives of workshop participants, and exploring what they might mean for New Zealand's future.

Measuring the impact of project on policy and strategic developments is harder at this early stage to quantify. However, anecdotal evidence suggests that some changes are becoming evident. At a high-level the trends and issues identified by the network are helping to define a broad context for policy development and operations in a range of areas (RS&T, environment, health and agriculture) and provide a valuable source of information against which to test policy options. Network reports have had positive impacts for MoRST in confirming existing thinking about particular issues, for example the potential of information and communication technologies and sensor technologies as tools for environmental monitoring and the implications for environmental management in New Zealand.

The scanning results have also directly influenced strategic thinking and planning within at least one of the participating departments, and generated new questions and active lines of enquiry for the futures section in another. The writing of the scanning reports has also stimulated immediate conversations about emergent issues and regulatory responses.

Most importantly however, the network's reporting has identified a range of areas that need further exploration and monitoring. This includes the direct stimulation of follow-up work on synthetic biology and nanotechnology regulation.

## 7. Next steps

Early success of this sort is only a beginning and does not obviate the need for continual improvements in the quality of the scanning reports and the interpretive processes.

MoRST undertook an interim review of the pilot phase of the project in early 2007, to assess whether the current configuration is meeting objectives and is sustainable over the longer term. In the meantime, the establishment of the network has already generated interest and capability in biotechnology futurewatch, which underscores the value of futurewatch practice generally, and has highlighted the connections between science and technology and the wider policy sector.

## Notes

1. See the websites for UK Defra Horizon Scanning and Futures programme at http://horizonscanning.defra.gov.uk/ (last accessed February 2007) and the USDA Center for Emerging Issues: http://www.aphis.usda.gov/vs/ceah/cei/ (last accessed February 2007).
2. See the UK OSI Horizon Scanning Centre of Excellence website at: http://www.foresight.gov.uk/HORIZON_SCANNING_CENTRE/index.html (last accessed February 2007).
3. The process design of the Australasian Joint Agency Scanning Network and the facilitation of joint agency discussions are provided by Kate Delaney, of Delaney & Associates Pty Ltd, Canberra, Australia.
4. Adapted with permission from AJASN (2006).
5. Professor Steven Rose, neurobiologist and Professor Emeritus, Open University; Visiting Professor, University College London.
6. This section uses the matrix of FTA objectives and impacts as reported by the European Foresight Monitoring Network (2005) as a basis for impacts analysis.

## References

AJASN (Australasian Joint Agency Scanning Network). 2006. *Horizon Watch Annual Report* Canberra, Australian Government,

Anderson, R.L., and A. Baxter, eds. 2004. *Dialogue: Theorizing difference in communication studies*. Thousand Oaks, CA: Sage.

Barre, R. and M. Keenan. 2006. Theme 2 – Anchor Paper: Evaluation, Impact and Learning. Second International Seville Seminar on Future-Orientated Technology Analysis: Impact of FTA Approaches on Policy and Decision Making, Seville, September 2006.

Bohm, D. 1996. *On dialogue*. London: Routledge.

Chasin, R., and M. Herzog. 1996. From diatribe to dialogue on divisive public issues – approaches drawn from family therapy. *Mediation Quarterly* 13, no. 4.

Checkland, P. 1981. *Systems thinking, systems practice*. Chichester, UK: Wiley.

Cooperrider, D.L. 2004. Introduction to *Advances in appreciative inquiry*. *Constructive Discourse and Human Organization*, vol. 1. Oxford: Elsevier Science.

Cronin, K., and L. Jackson. 2004. *Hands across the water: Developing dialogue in the New Zealand biotechnology debate*. Wellington, Victoria: University of Wellington.

Glenn, J.C., and T.J. Gordon, eds. 2003. *Futures research methodology version 2.0*. Washington, DC: AC/UNU Millennium Project.

Hajer, M.A., and H. Wagenaar, eds. 2003. *Deliberative policy analysis – understanding governance in the network society*. Cambridge: Cambridge University Press.

Kemmis, S., and R. McTaggart, eds. 1988. *The action research planner*, 3rd edn. Melbourne, Victoria: Deakin University.

New Zealand Government, Royal Commission on Genetic Modification. 2001. *Report and Recommendations*. Ministry of the Environment, Wellington, New Zealand. Available at http://www.mfe.govt.nz/publications/organisms/royal-commission-gm/index.html (last accessed February 2007).

New Zealand MoRST (Ministry of Research, Science and Technology). 2003. *The New Zealand Biotechnology Strategy*. MoRST, Wellington, New Zealand.

———. 2005. *Futurewatch: Biotechnologies to 2025*. Wellington, New Zealand: MoRST.

OECD. 2005. *Governance of innovation systems, vol. 1: Synthesis report*. Paris: OECD.

———. 2006. *The bioeconomy to 2030: Designing a policy agenda*. Paris: OECD.

Ramon, J.M. 2005. Dimensions in the confluence of futures studies and action research. *Futures* 38: 642–55.

Rowe, G., and L. Frewer. 2005. A typology of public engagement mechanisms. *Science, Technology and Human Values* 30: 251–90.

Schon, D.A. 1983. *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Senge, P.M. 1990. *The fifth discipline: The art and practice of the learning organisation*. New York: Doubleday.