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Dialogues at the interface: an introduction

Louk Box[1]

It is trite to state that science and technology (S&T) are a necessary condition for economic development. It would be more relevant to ask the question: how are S&T policies linked with development policies? What have we learned from the many lessons, so that effective policy experimentation can take place?

This is one of the key issues in current debates around science and technology for development. As argued in the report of the UN Millennium Project Task Force on Science, Technology and Innovation,[2] there is an urgent need for policy experimentation to stimulate learning in developing countries. The international community set itself the Millennium Development Goal (8, target 18) to 'make available the benefits of new technologies'. If it is serious about achieving this target, the report argues, new avenues of policy learning will need to be opened up and changes in traditional social relationships will need to be made.

This book is about those changing social relationships. The authors focus on the question of what social relations make for successful science and technology policies. In particular, the various chapters illustrate what happens at different social interfaces, such as between policy makers and researchers, and between the users and producers of knowledge. In other words, they are interested in the knowledge networks that are emerging between the many different actors involved in the development of science and technology.

This book is the outcome of a workshop that brought together scholars and policy makers from the global South and the North, from private and public organizations, to review their experiences. A plant geneticist working with a multinational company was able to share views with a civil society leader; an African policy maker argued with an Asian technology researcher. This made for a great diversity of views stemming from neo-

1 Louk Box (box@iss.nl) is Professor of International Cooperation and Rector at the International Institute of Social Studies, The Hague, the Netherlands.
2 UN Millennium Project (2005: 1).

classical economics to constructivism. The ensuing papers therefore do not share one theoretical background. What did unite the authors was a common concern for research–policy linkages. In this context, research was taken to mean any systematic effort to increase the stock of knowledge, and 'policy' as any purposive course of action followed by an actor or set of actors.[3] Linkages are seen as the communication and patterns of interaction among the actors involved. Such patterns may consolidate into knowledge networks in which information is evaluated or prioritized. A number of authors stress the communication aspect of such patterns, especially in the form of dialogue between actors or, through them, between institutions like ministries, universities or companies. The title of this book reflects this orientation: *Dialogues at the Interface* refers to communication between these different institutions.

The Netherlands Directorate General for Development Cooperation (DGIS) co-sponsored the workshop because it wished to learn from experiences in science and technology for development. Policy learning[4] has become an increasingly important issue within DGIS and the Netherlands Ministry of Foreign Affairs. After the path-breaking study of its Swedish sister agency, *Does SIDA Learn?*,[5] DGIS tackled this question by proposing new approaches to policy learning, especially in the area of development-oriented research, or science and technology for development. Theo van de Sande gives a review of the relevant Dutch policies in the 1990s. The Netherlands is interesting in this respect because it used to be one of the larger donors,[6] it initiated demand-led development research, and supports a development research advisory council with a balanced representation from the global South and North.

In *Priority setting in research for development: a donor's perspective*, van de Sande elaborates on what came to be known as the 'Ganuza dilemma'. Essentially this comes down to the question 'who will formulate whose demand', or, who is to choose the priorities if no consensus exists among the scientific, economic and political communities in a developing country. In the past, Northern researchers often did so, but this led to fragmented or policy-irrelevant research. DGIS therefore adopted a three-step approach: 'First, identify the groups in the developing country whose interests should be served by a specific research programme, on the basis of development criteria. Second, identify local researchers who are closely affiliated with that group. Third, accept priorities that are the result of a conditioned demand orientation in a dialogue with the research and policy-making partners'. Van de Sande's contribution provides good reading for those who wish to learn from that approach: there are no short cuts to demand-led research priority setting. What is needed is the availability of trusted communication channels at the interface between the groups one wishes to serve, and the researchers who are interested in doing so. In many cases, too few stakeholders were involved, the research was spread too thinly, and the resulting impact was therefore limited.

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3 See the chapter by Court and Young.
4 Kan (2005:1).
5 Swedish Court of Auditors (1988).
6 Box and de Boer (1994).

Networks of intellectual freedom fighters in Africa

In the first essay, *Knowledge dependence and its discontents: the demand for policy research in Africa in the era of globalization*, Osita Ogbu pinpoints the need to use existing knowledge networks, or generate new ones. He argues that new intellectual freedom fighters are emerging. After independence 'there was a congruency between the intellectual ideology of the time and the development policy focus', which led to strong research–policy linkages. Subsequently, globalization 'fostered knowledge dependence, through un-negotiated policy options that tied development aid to the acceptance of 'external' knowledge'. Yet the emergence of policy networks like the African Technology Policy Studies Network (ATPS) allow for new linkages between research and policy.

Such platforms provide a market for the contestation of policy ideas and for policy entrepreneurship that is critical in bridging the research–policy gap. Ogbu argues that policy research priority setting involves many players and can be demand or supply driven, depending on coalitions for policy change and institutional arrangements on the ground. In Africa, he concludes, all of these conditions have been either weak or absent: 'few researchers and policy makers understand the importance of generating technology from technology, the wider implications of technological innovation for Africa's economic renewal, or the need to re-engineer existing institutions to supply knowledge to the productive sectors'. Given 'little capacity in this field, it has been difficult to generate any demand for research or for senior scholars to assume the role of S&T policy entrepreneurs or champions'.

Ogbu stresses the need for policy platforms that will allow policy entrepreneurs to articulate supply and demand. New institutions like the New Partnership for Africa's Development (NEPAD)[7] can do this, since they work at the continental level, to bring together expertise in research and policy. Through innovative approaches like ATPS and NEPAD, a demand for science and technology policy research is being created. They can sensitize policy makers to the relevance of such research in the policy process and integrate technology planning in economic and social plans. They can provide for the necessary training and organization of researchers so that they are capable of influencing policy. Last, but not least, such institutions can generate the entrepreneurial skills that are needed to translate ideas into action.

John Mugabe, however, wonders why regional agreements have performed so poorly in Africa. In his contribution, *Regionalism and science and technology development in Africa*, he shows that Africa currently boasts some 20 regional agreements. Although most of them refer to science and technology (S&T), very few have 'collectively harnessed and applied S&T to solve common development problems'. Why is this so?

Mugabe argues that institutional conditions need to be satisfied before technology policies can be made effective. He shows that regionalism 'remained elusive' after

[7] See the chapter by Mugabe.

independence, partly due to problems in individual countries that could not be solved collectively. He sees globalization as one of the reasons for the renewed interest in regionalism, particularly in relation to developments in S&T, including information and communication technologies (ICTs). Regionalization is fostered by cheaper communication, allowing for greater transboundary movements of people, goods and finance. His analysis of regional (COMESA, SADC) or continental cooperation agreements (AU) reflects this rekindling of interest in S&T. In addition, African governments are increasingly subscribing to international or global agreements with implications for S&T development (like the Convention on Biological Diversity, the UN Framework Convention on Climate Change, and the Montreal Protocol on Substances that Deplete the Ozone Layer). It is these agreements that allow for institutional development and for policy learning in an African context on the basis of greater international cooperation.

Seven factors determine Africa's limited capacity to harness S&T for development:

- the links between scientific and political institutions are weak;
- S&T policies focus on organizational rather than on programmatic issues;
- too little, and in many cases declining, funding for R&D;
- the quality of science and engineering education is declining at all levels;
- the loss of scientific and technical expertise to other regions of the world;
- R&D institutions in many countries are getting weaker; and
- the links between public R&D institutions and private industry are weak.

Through NEPAD, Mugabe argues, innovations in regional cooperation are being made. An African Ministerial Council for Science and Technology now exists. Networks and centres of excellence in science and technological innovation are being established, such as the African Laser Centre, the Biosciences Initiative and the Biosciences East and Central Africa (BECA). In addition, 'an advisory panel on biotechnology' exists, 'a working group to design common African indicators or benchmarks for assessing the status of S&T, and a task force to encourage more African women to engage or participate in science and engineering. Each country has also committed itself to increasing national annual public expenditures on R&D to at least 1% of GDP'. NEPAD has mustered political support for such initiatives and maintains the political will to put S&T on the agenda of individual countries, regional arrangements and continental institutions like the African Union. By strengthening the ties between scientific and political institutions and concentrating on particular areas (like biotechnology), funding for S&T policies could be acquired. Yet the most important element of all is that African scientists are speaking to African policy makers. Through the NEPAD network African priorities can be translated into relevant research programmes and, ultimately, policy measures that involve both public and private actors.

Towards a critical mass of researchers in Latin America

How can developing countries create and maintain a critical mass of researchers able to consistently and systematically contribute to a knowledge base? This is the focus of Léa

Velho's contribution, *Building a critical mass of researchers in the least developed countries: new challenges*. Using a case study of capacity building in Nicaragua, she analyzes the material on the basis of a model of knowledge production first proposed by Gibbons *et al*.[8] The latter note that a new mode of knowledge production is emerging that is more in tune with the demands of poor people in poor countries. The existing mode of knowledge production is characterized by hierarchical relations within disciplines, allowing for little transdisciplinary exploration, through strict peer-review standards; the model is rather closed to influence from outsiders. Juxtaposed with this so-called mode 1, Gibbons *et al.* develop a mode 2, which is characterized by horizontal relations involving different disciplines, allowing review and influence from 'outsiders' or users, because knowledge is generated in the context of its application. Velho takes this distinction one step further, and wonders what its implications are for creating a critical mass of indigenous researchers who can respond to local realities.

She notes that mode 1 resulted in 'one type fits all' recommendations to train researchers according to standards set in Northern universities. Policy makers would copy these and training programmes would be developed accordingly. In both the North and in the South, however, the limits of the model have become clear. Mode 1 capacity building will not work in developing countries since 'it takes too long, it requires resources not available in those countries, and it does not attend to criteria of social relevance which are currently required of public universities'. Alternative paths were developed in mode 2 fashion. 'In policy terms, research training is being "decoupled" from its strong association with academic careers and the reproduction of the academic profession'. Velho therefore wonders 'how does this debate on the changing nature of knowledge production and use affect research training in the least developed countries (LDCs), which have not yet been able to develop a critical mass of researchers, nor have the educational structures to train them.'

To answer this question Velho studied a research capacity building programme in Nicaragua. Funded by the Swedish SAREC, it aimed 'to strengthen research capacity and support research which can contribute to the solution of important development problems of Nicaragua'. In other words, problem-oriented research capacities were to be generated. It meant that the mode 2 discourse was adopted, and participatory approaches or demand orientation were stressed. In practice, however, Velho notes that a mode 1 logic was followed, dictated by the very structure of SAREC's interventions. Even though SAREC wished to follow a participatory and demand-oriented approach it was forced to impose a rather top-down mode 1 logic. This limited the effectiveness of its programme as Velho demonstrates.

What is the general relevance of this argument? Velho notes that the Nicaraguan case is not unique. Graduate training in developing countries can be singularly ineffective in creating a critical mass of research capacity. Doctoral training often leads to dissertations or articles, which may be read by no one in the country concerned and are therefore ineffective. The production of such articles or books does not correlate with technological development for Velho's native Brazil, which boasts significant graduate training, yet

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[8] Gibbons *et al.* (1994).

‘Brazil’s potential in the global knowledge economy remains largely unrealized’. New links with private enterprise and other actors are needed to generate significant innovations.

The inefficiency of the prevalent model needs to be corrected. Graduate students often work for years individually, whereas we know that effective links are made through teamwork. The selection of research topics is, moreover, based on mode 1 criteria in the sense of the contribution to a disciplinary stock of knowledge, which may preclude local relevance. Nicaraguan students would study in Sweden, requiring time for adaptation, and weakening their links in the national research context. Most importantly, the SAREC model makes for a fundamental asymmetry in relations, due to the funding arrangement and a lack of awareness of Nicaragua’s contributions to the programme.

Velho therefore concludes ‘that it is very unlikely that LDCs will be able to build research capacity simply by adopting the research training schemes developed in the advanced countries and offered by development cooperation agencies. Such schemes are based on a mode 1 knowledge production and utilization’. She calls for a mode 2 approach, which ‘would mean that capacity building would focus not only on graduate education, but also on creating opportunities for interactions among researchers and between them and other social actors, bringing together different types of knowledge that are necessary to address a particular problem’. New ‘dialogues at the interface’ are required for significant capacity development.

An epistemic community at work in Asia

Sunil Mani takes us to Singapore, where everything seems to work. In the unique environment of this technological city-state an S&T innovation system has been developed that is the envy of many countries. Singapore first developed a critical mass of research scientists and engineers, and then put in place a set of research grants to encourage both local and foreign enterprises to invest in R&D. In other words, it did what Velho calls for in her contribution to this book. How did this work – did Singapore follow a mode 2 approach? What measures were taken or policies enacted, and how did they come about?

In *Epistemic communities and informed policy making for promoting innovations*, Mani argues that a largely informal yet highly effective local network of scholars and policy makers provided guidance – an epistemic community. According to Haas, this is ‘a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within the same domain or issue area’.[9] In other countries without such communities to aid government policy making, most policy instruments fail to achieve the desired results. In the absence of informal professional networks, innovation policy making tends to be *ad hoc* and subject to political compulsion. The genius of the Singapore model appears to lie in a specific

[9] Haas (1992: 3).

arrangement at the interface: a remarkably effective linkage among top politicians and scientists.

Singapore was chosen as a case study because of the dramatic improvements it has made in its innovation system, without the bureaucracy of a Ministry of Science and Technology. Moreover, it has successfully made the transition from electronics manufacturing to research in the life sciences and biotechnology. How?

Mani begins by asking how expertise can be mustered to guide effective S&T policy making. Countries with much expertise can use the elaborate process of green papers and white papers to involve different actors and stakeholders. National advisory councils may be utilized as rather formal or structured assemblies of certain actors. 'Epistemic communities need to be distinguished from bureaucratic bodies. The latter operate largely to preserve their missions and budgets, whereas epistemic communities apply their knowledge to a policy undertaking, subject to their normative objectives. Thus, members of an epistemic community are not policy entrepreneurs'. However, 'the existence of epistemic communities within otherwise bureaucratic bodies has allowed some developing countries to graduate within a short time from being mere assemblers to designers, manufacturers and exporters of high-technology products'. This arrangement allows for flexible linkages on the one hand, yet it also permits rapid decision making and implementation of policies, especially if the political leadership is involved.

Singapore started its biotechnology venture in the 1980s with the creation of a molecular biology research centre, in much the same way NEPAD is doing in Africa, as described by Mugabe. It dramatically increased funding for the sector, especially for capacity development in the form of training programmes for life-sciences researchers. At the same time it attracted foreign investment and companies, where the graduates could be employed. Gradually an indigenous research capacity developed and local patents could be registered. Mani notes that 'with high-tech products now accounting for more than 50 per cent of manufactured exports, Singapore has the rare distinction of being a major competitor on world markets'.

In the case of Singapore, a few trends stand out:

- the high levels of public expenditures in education, with sustained growth;
- the absolute priority given to the natural sciences and engineering;
- partnerships with top universities abroad;
- the creation of public research centres, linked to industrial (private) needs; and
- a wide variety of incentive schemes to attract capital.

It is this carefully managed mix of institutional development (through government) and informal priority setting (through the epistemic community) that appears to underlie Singapore's success. It was the very creation of a critical mass of researchers, at the outset, which allowed the effective distribution of incentives in a later phase. Mani therefore concludes that policy sequencing is one key to success. From another perspective it appears that such sequencing allowed policy learning in the epistemic community, which could so maintain its influence on policy making. Such learning

results in ‘informed policy making [which, in turn,] leads to better and more relevant policies demanded by the users – firms and research establishments’.

Singapore may well be exceptional in its capacity for policy learning. Yet other countries could learn from the peculiar mix of carefully orchestrated formal instruments and informal priority setting at the interface between the worlds of science and policy. One question that remains is the extent to which the Singapore model can be characterized as a mode 2 approach to capacity building in Velho’s analysis. Surely, a user orientation dominates and knowledge production in the context of application; and surely outsiders (like politicians) are involved in the process of priority setting (as in the epistemic community). Yet just as surely, the approach does not rhyme with a democratic or participatory logic allowing the balancing of *different* research agendas, or necessarily with transdisciplinary dialogue.

Linking research agendas in South Africa

How do *different* research agendas reflect and represent the research interests of constituencies? That is the question that Johann Mouton raises in his chapter, *Science for transformation: research agendas and priorities in South Africa.* If Mani argued in favour of one coherent agenda, Mouton faces the co-existence of different research agendas, which were (or could be) in conflict with each other. The case of South Africa is special in that under apartheid, it reflected a situation analogous to that in Singapore, but driven by an all-white epistemic community. The African National Congress (ANC) developed a counter-agenda, through probably an equally coherent epistemic community, which, however was more inclined to follow a mode 2 approach. What happened after the ANC took over to promote science for social transformation?

The ANC found the apartheid research agenda to be fragmented, uncoordinated and not serving the interests of all South Africans. It therefore proposed a drastic reversal of priorities that was in line with national socio-economic imperatives, thus serving the entire nation. The agenda could follow some of the lessons learned by the NGOs that had confronted the apartheid regime, which were based on university campuses. In this way, it linked up with local community priorities, in line with mode 2 prescriptions. The ANC government then followed the course outlined by Mani – it issued a green paper, and then a white paper that was based on the notion of a national system of innovation. The final aim was to serve the needs of the entire nation rather than any particular interests.

A special place was given to the interests of marginal groups like the rural poor, or women. These do not have a voice in most agenda-setting forums, but through the mentioned NGOs they were, however, heard. In the past such NGOs had not received government funding, but had obtained support from donor agencies such as SAREC, or indeed, DGIS. Given their activist stance, they were trusted by the respective constituencies. In van de Sande’s terms, the Ganuza dilemma had been resolved … for the time being. Mouton notes that with the arrival of formal research funding schemes under the ANC government, these NGOs were starved of support. Donor support had to

be channelled through the formal research institutions and so could no longer reach the activist NGOs, and, it could be added, a mode 2 type of knowledge production reverted to mode 1.

How then, are the interests of different constituencies represented in the current setup in South Africa? Mouton reports survey data of 2002 in which intended beneficiaries are cross-tabulated with the type of research organization. He concludes that most research was 'carried out for specific contracting agencies, industry, government and specific interest groups'. The poor had disappeared.

Mouton goes one step further and distinguishes between the *directionality* of the research agenda ('who are the main actors driving the process?') versus the *degree of interventionism* in agenda setting (the 'steering versus shaping of research priorities'). He argues that government and business are the main actors. There is little space for 'alternative' agenda setting, as happened through the South Africa–Netherlands Partnership for Alternatives in Development Programme (SANPAD)[10] in the case of HIV/AIDS research. This programme continued to function outside the government, and could thus maintain its poverty orientation. The poor reappeared.

On the whole, however, the production of scientific knowledge in South Africa is strongly tied to 'white, male and ageing scientists' who produce 90 per cent of all articles. In this sense the ANC government has not succeeded in its ambition to transform South African research. Even though the government formally indicated that it would go for mode 2 type knowledge production, the reality has turned out to be 'somewhat different', according to Mouton.

In fact, a 'homogenization of demand' has occurred instead of a heterogenization or confrontation of different research agendas. With 'steering from the top', there has been an 'increasing blurring of institutional boundaries'. Paradoxically, the result achieved has been the opposite of what was intended; whereas the government intended to follow a mode 2 type of knowledge production leading to diversity, a mode 1 dominated process emerged that left the poor and the marginalized aside. The question then becomes: 'how can a developing country such as South Africa create/generate demand for research that is *heterogeneous* in terms of the range of interests it serves, *representative* of who is involved in the research, and *critical* in terms of the nature of the research to be conducted?'

Mouton analyzes a case in which research demand is articulated through a diversity of actors. He shows that the 'articulation of research demand occurs in self-organizing systems which in turn are embedded in other related networks'. This brings us back to the main focus of this book; if 'dialogues at the interface' of different institutions are promoted, diversity can be realized in S&T policy for development. The question then becomes: are there tools for promoting such dialogue which are not location specific?

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[10] See the chapter by van de Sande.

A toolbox for policy dialogue

How do we make a trustworthy description of the research, technology and development situation in a country that allows for dialogues at the interface? Wiebe Bijker outlines the main ingredients of a methodology. He warns that no methodology can serve as a recipe, yet it may contribute to the creation of a new cooperation strategy between different actors or stakeholders.[11]

Bijker follows a constructivist approach. 'Scientific knowledge is constructed in laboratories, on the land of small farmers, in the offices of funding agencies, at international conferences, and in editorial offices. It is not a matter of asking clever questions of nature, who then shouts back a clear 'yes' or 'no'. He argues that such an approach allows for '*the very possibility* of a policy dialogue on the contents of an S&T policy agenda', since 'technology is not constructed merely by engineers, but also by marketing departments, managers, anti-technology action groups and users'.

The author proposes 'an extended conception of policy dialogue that, in addition, recognizes the socially constructed character of science and technology and therefore stresses the need to encompass a variety of other aspects as part of a successful research and technology for development policy'. In this way he solves the Ganuza dilemma referred to above, and allows for an approach as argued by Mouton. More actors can become involved, and more institutions like firms, universities, NGOs or indeed government departments.

He distinguishes various levels of dialogue that can usefully be applied to the cases examined in this book. *Intra-national* dialogues involve national organizations and local stakeholders (as in the contributions by de Lattre-Gasquet, Mouton, Uijtewaal, Velho). *Intra-regional* dialogues involve actors from several countries (as in the studies by Mugabe and Ogbu). *International* dialogues involve actors from different regions or at the global level (as in the chapters by Dufour, Gaillard *et al.* and, to a certain extent, Wagner).

Bijker stresses that 'to be a true *dialogue*, the policy dialogue must be interpreted as an ongoing, *open learning process*'. He provides specific indicators for the process to be open and learning-oriented. Policy dialogue and policy learning are thus operationalized and can be tested in practice – they are no longer blurred concepts, but have 'come of age'. Bijker shows how S&T policy dialogues need to be embedded in broader development policies, especially those dealing with the effects of globalization. He specifies the types of actors and issues to be raised, and the landscape in which they function.

Gradually, Bijker develops his toolbox which includes a 'checklist for designing and evaluating diagnostic studies, a workshop for training researchers, and advice to the relevant government agency to prepare the policy-making infrastructure'. The workshop

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[11] See Wieberdink (2004).

is conceived as a ‘learning laboratory’ for all; the diagnostic study allows for dialogue along institutional interfaces. The question that still needs to be answered, however, is what has been the practical experience with these types of policy dialogue.

Bridging the research–policy divide

How can policy makers best use research for evidence-based policy? How can researchers promote their findings in order to influence policy? How can interactions between researchers and policy makers be improved? Julius Court and John Young address these questions in *From development research to pro-poor policy: evidence and the change process*, on the basis of the ODI’s Research and Policy in Development (RAPID) programme. The programme examined a large number of case studies, in an attempt to pinpoint what happens at the researcher–policy maker interface.

Conceptually, the programme distinguishes between three spheres or clusters of issues embedded in an environment of external influences:

- context issues, pertaining to politics and institutions
- evidence issues, highlighting approaches and credibility
- links issues, concerning influence and legitimacy.

The issues derived from 50 case studies and a literature review of relevant material regarding civil society influence on policy making. The programme commissioned detailed case studies and evaluations and invited experts from very different backgrounds to review the findings. Through a process of ‘triangulation’ and peer review, they then assessed the impacts of research on policy.

According to Court and Young the main factors that affect research uptake into policy are as follows:

1. *political and institutional context*, including variables such as ‘power relations, political contestation, institutional pressures and vested interests’;
2. *policy maker demand*, including the need for ‘consensus on the nature of the solution’;
3. *the influence of street-level bureaucrats* on implementation;
4. *topical relevance* for policy issues of the day;
5. *the perceived credibility* of key researchers and their approaches;
6. *operational usefulness* or problem-solving capacity;
7. *presentation or packaging* of results in appropriate language;
8. *interactivity* between researchers and policy makers and the emergence of formal or informal networks;
9. *epistemic communities* that allowing for the exchange of perspectives; and
10. *the legitimacy of researchers*’ *links* to relevant local communities.

Again, these factors can be tied to the studies presented in this book. Mugabe analyzes the political and institutional context and the relative effectiveness of regional groupings in Africa. Policy maker demand comes back in Ogbu’s provocative analysis; the

influence of street-level bureaucrats appears in Velho's analysis of SAREC, and in van de Sande's discussion of the Dutch agency DGIS. Mugabe clearly illustrates topical relevance (biotechnology, ICTs), which also figure prominently in the studies by de Lattre-Gasquet and Mani. Researcher credibility is an issue addressed by Uijtewaal, and the study by Gaillard *et al.* of the IAEA exemplifies operational usefulness. Mani's analysis clearly shows interactivity in the close formal and informal ties in Singapore's epistemic community. Bijker and Mouton insist on the relevance of researcher–community linkages.

Court and Young raise a number of unanswered questions concerning, for example, the effects of democratic governance, the role of civil society institutions and access to international research and policy networks. We now know that networks matter, but how do they work, and why?

Emerging global knowledge networks

The networks created by international collaborations in science and technology (ICST) offer opportunities for developing countries to acquire knowledge for local development. Such collaboration represents a growing share of scientific activities, Caroline Wagner argues in her contribution *International collaboration in science and technology: promises and pitfalls*. What are the dynamics of such networks and how can they be put to use by policy makers and researchers?

Wagner bases her analysis on a remarkable set of data on the authorship, including co-authorship, of scientific publications in 1990 and 2000. She wished to know if scientists from developing countries participated in co-authoring, thus indicating a virtual network between authors in the global South and North. She found that a significant change had occurred over the decade – 'at the regional level, researchers from more countries joined in collaborative research, as evidenced by co-authorships in internationally recognized peer-reviewed journals'. She confirms the findings of Mugabe and Ogbu that in this period the African network became much better integrated and centred on a few hubs, or centres of excellence. For both Africa and elsewhere she indicates that countries that were peripheral in 1990 became 'more closely tied to the regional level in 2000'. Regional hubs, in other words, take their place in a global system that cannot be simply characterized by a flat centre–periphery model under US–UK dominance.

Nevertheless, there is still a clear hierarchy in the networks, with the most scientifically advanced countries as core members. The relevance of the regionalization that Wagner proves from her data is that new strategies at local, national, regional and global levels can be considered. At the local level, research institutions link with local communities, as Mouton has shown. The national level is the level at which funding and fiscal or other incentives are organized, as shown so clearly by Mani in the case of Singapore. The regional level allows knowledge sharing among states with common problems, like the Southern African region analyzed by Mugabe. The global level is for megascience projects in fields such as nuclear physics. Wagner brings these and other considerations

together in a framework for evaluating special considerations for stakeholders in ICST decision making at the different levels.

Through her painstaking analysis of co-authorship networks, Wagner opens a window onto the global organization of science and technology. Through a judicious capacity development at the local or national level, contributions to and from the regional or global level are realized.

Going global: cooperation in knowledge-based development

Most of the essays in this volume deal with the local, national or regional levels of policy making. But what happens at the global level of S&T demand-led policy and practice? In their chapter on *Priority setting in technical cooperation: expanding the demand for knowledge-based development*, Jacques Gaillard, Royal Karstens and Ana María Cetto describe how the Technical Cooperation Programme of the International Atomic Energy Agency (IAEA) evolved from a technology-driven to a demand-based approach. They deal with the question: what conceptual and organizational changes were made to foster demand-led research at the national level?

IAEA's roots go back to the 1950s, when US President Eisenhower stressed the need to control the spread of nuclear materials while ensuring their benefits for all of mankind. From the start, technical assistance was a major activity, leading to the creation of a technical cooperation programme in the 1960s. In 1997 a new approach saw the light and the orientation to nuclear technology changed into one stressing national capacity development and institutional self-reliance. The IAEA changed from a technology transfer approach to one aiming at sustainability and local ownership through country programme frameworks based on thematic planning. This change, by the way, was not unique to the IAEA, but also happened at other international organizations like UNDP and the World Bank.

The change meant that IAEA gradually became involved in a wide variety of activities, prioritized by its member states, like human health, agricultural productivity, water resources management and the environment. As noted by Mugabe, Ogbu and Wagner, regional cooperation agreements became ever more important, through regional resource units that provide both research and training facilities, and centres of excellence. Current technical cooperation priorities therefore include human health (24%), nuclear safety (24%) and agriculture (12%).

Gaillard *et al.* argue in favour of continuing the trend towards regional and national institutional development through capacity building or knowledge transfer. In answer to the questions 'how can development strategies become more knowledge based?' and 'how can research strategies be more demand based?' the authors propose that greater use be made of knowledge brokers working at the intersection of different institutions. Such individuals could periodically assess programme effectiveness in terms of local development constraints. In line with other authors in this volume, they argue that

‘science and development partnerships work best in proximity to the problem where collective efforts can harness the labours of those most seriously affected with those capable of effecting the necessary scientific and technological advancements’.

Harnessing foresight: exploring the future

What S&T development options are available, and how can we best harness their potential? Marie de Lattre-Gasquet, in her contribution, *The use of foresight in setting agricultural research priorities*, shows how foresight activities can be useful tools in public decision-making processes. Research organizations can use foresight activities to assist in the definition of research priorities, which in turn can help in meeting future challenges.

Foresight is ‘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 the emerging generic technologies likely to yield the greatest economic and social benefits’. It allows preparation for different futures, by identifying current trends, and by proposing different courses of action. It allows ‘collective learning […] with a view to long-term strategic decision making’.

Through problem definition, system parameter setting, scenario development and strategic choice formulation, possible futures are explored. This process allows for communication among stakeholders or actors and a focus on the longer term. Coordination of actor strategies thus becomes possible and a shared world vision or consensus may come about, leading to commitment among key actors. In essence, this is quite close to the notion of the epistemic community in the Singapore case described by Mani.

De Lattre-Gasquet concludes that ‘S&T foresight looks at science in progress (‘*la science qui se fait*’) and fulfils a number of functions. 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’.

In order to be effective in evaluation and planning, such foresight activities need to be embedded in research organizations. The author presents three case studies to show how this can be done, at the level of a commodity (cocoa), a country (the Netherlands) and the world (futures for food, agriculture and the environment). In each case, she shows how interactions between researchers and stakeholders took place, allowing for dialogue and, in the end, for consensus and commitment. Foresight can therefore be considered as another toolkit for dialogue, alongside the one proposed by Bijker.

Public–private partnerships

Much reference is made to public–private partnerships in S&T, but precious little empirical material is available on specific examples in developing countries. The UN Millennium Project report[12] attaches great importance to the role of the private sector, yet the question can be asked: why do we have so few good case studies? In preparing for this workshop, the same problem arose. Few private firms were willing or able to contribute to our common understanding of what they do, what problems they face, and what strategies they have chosen. In terms of de Lattre-Gasquet's analysis, it proved to be hard to involve private sector actors in our foresight activity.

It was therefore very fortunate that Bert Uijtewaal did take part. The title of his contribution, *Development of sustainable control of diamondback moth in cabbage and cauliflower by public–private partnership,* may sound technical, but the reality of the case is remarkably practical. How can a partnership be made between a public and a private actor in solving an insect problem through genetically modified (GM) crops? The technical problem, he points out, is relatively simple in comparison with the legal and social issues that emerge when advanced S&T innovations such as genetic modification are involved.

Crop losses due to the diamondback moth cost the global agricultural sector US$ 1 billion each year. Natural enemies are 'rarely sufficiently effective, and so must be supplemented with other control tactics', and plant breeders have not succeeded in developing resistant varieties. Uijtewaal's company therefore developed sustainable resistance through the introduction of two genes from a soil bacterium *Bacillus thuringiensis* (Bt) with which there is wide experience in other crops like cotton and corn. Although no significant environmental or health problems have emerged, this genetic modification has been the subject of NGO lobbying and advocacy worldwide.

Aside from the possible ecological consequences (genetic pollution), the use of GM plant material has important legal consequences. The 'project concept' therefore started from the premise that the private partner would invest in 'making the product', and the public partner in 'releasing the product'. The latter included field testing, human and environmental safety assessment and socio-economic impact assessment.
The company would transfer its intellectual property (IP) rights free of charge to a public organization, which in turn would make it available to local farmers and breeders. This meant that the public partner would become the IP holder, with the associated rights and duties, but the company reserved the right to 'develop its own hybrids that may be released in parallel with the public varieties'.

Uijtewaal concludes that the main challenges are not technical but organizational. Who will own the intellectual property of the plant material and the regulatory dossier that goes with it? Who will pay for product release? Who will manage the partnership and

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12 UN Millennium Project (2005).

guard the public interest to ‘ensure the safe and sustainable use of the material’ or its reproduction? These are only some of the questions that the partnership faces and show how delicate public–private cooperation arrangements can become.

This case also shows the diverse range of interests that need to be brought together, at local, national and even global scales. Public interest groups in the North (such as Greenpeace) have serious reservations about GM; governments in the South may not know how to find a balance between national interests and global concerns; and Northern donor agencies might find themselves right in the middle (as Dufour argues). Individual researchers in multinational companies (like Uijtewaal) may see the public and private benefits of a new technology, yet the boards of these companies will also be concerned about their public image. The IAEA case shows that only through timely investments in both regional and national institutional capacity development can the problems for complex technologies like biotechnology be reduced.

‘Joining up’ knowledge for development

Paul Dufour provides a fitting ‘coda’ or final chord for this volume. In his essay *The emerging contextual space for priority setting in development research,* Dufour reflects on his long experience in the field as a staff member of the Canadian International Development Research Centre (IDRC). He argues in favour of policy learning and suggests that more ‘joined up decision making’ is required. This will require, among other things, taking a hard look at science advisory bodies, science communication and public engagement. His chapter brings together many of the issues raised elsewhere in this volume, and broadly outlines the future we face in the realm of S&T for development.

Based on an analysis of case studies undertaken by IDRC in India, the Maldives, South Africa and Vietnam, Dufour concludes that in these countries ‘good governance, strong economic development and well developed social and environmental practices are all dependent to some extent on a sound knowledge strategy’. Such strategies need ‘to be embedded in decision structures that are both independent of states, but also linked to some form of accountability’. They need to be independent to allow for legitimacy, as argued by Mouton; they need linkages to provide policy coherence, as argued by Mani. Dufour points out that the mushrooming of new actors (like advocacy groups) is not necessarily for the better of society. Yet governments, NGOs and researchers are all actors in a new form of knowledge production, leading to complex and multiple knowledge networks.

The question then becomes: how do the different actors take their responsibility for ‘socially inclusive innovation’ at the global level, and what role do knowledge networks play? A global science advisory board does not exist, even though certain institutions provide clues about its possible emergence. Dufour mentions the InterAcademy Council, which brings together a worldwide group of national academies. At the outset of this introduction, reference was made to the UN Millennium Project Task Force on Science,

Technology and Innovation. These developments indicate that knowledge networks are increasingly becoming integrated and provide a research–policy nexus (as argued by Court and Young).

Yet, Dufour argues, we first need to face a number of challenges. 'Knowledge networks of the future, especially those affecting the South, will be challenged by at least three key facts – that knowledge does not substitute for ethics, that new technologies require social and institutional innovation, and that geopolitical developments may hamper rather than strengthen international knowledge networks'.
This requires a 'renaissance of development research' at the level of international organizations and the donor agencies that support them.

Wrapping up

Networks involving producers, brokers and users of knowledge play an increasingly important role in bridging gaps to promote 'socially inclusive innovation'. The authors in this volume concentrated on the place where these actors meet, at the research–policy nexus.

The volume shows that we may move beyond the traditional dichotomies, like the one between mode 1 and mode 2 knowledge production. Maybe it is time to argue, as some have done,[13] in favour of a mode 3 of knowledge production that is highly diverse in nature, yet carries elements of disciplinary knowledge production, which is user context sensitive and involves knowledge networks composed of different actors. Possibly, mode 1 is increasingly becoming a caricature given the changes in the world of science and technology, as Dufour argues. And, just as possible, the mode 2 type of knowledge production was an ideal that even in the case of South Africa was hard to achieve, according to Mouton.

What remains is the need for dialogue among the relevant actors. This is easier said than done, as Uijtewaal describes, even if the good will is there among most actors. Yet, as the contributors to this volume conclude, the need for dialogue at globally emerging interfaces is clearly evident.

[13] Box (2001).

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