Netherlands
Development Assistance
Research Council

Utilization of Research for Development Cooperation

Linking Knowledge Production to Development Policy and Practice

Publication no. 21

RAWOO, the Netherlands Development Assistance Research Council, was established at the request of the Minister for Development Cooperation, also on behalf of the Minister of Education, Culture and Science, and the Minister of Agriculture, Nature Management and Fisheries. Its mission is to advise the government on matters of policy regarding research on development problems, and to keep the government informed of developments in this area.

RAWOO is part of the system of Sector Councils for research. Their job is to attune research to the needs of society and to ensure an optimal match between supply and demand in the different fields of research for which they are responsible. In the case of RAWOO, the needs in question are these of societies in developing countries. Sector Councils function on the basis of tripartite discussion between government, researchers and the users of research.

The Council has fifteen members including the chairman, plus one advisor from each of the three ministries. Six of the members come from developing countries. Members are appointed as individuals rather than as representatives.

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Preface

Since 1989, RAWOO has been organizing lunch lectures in cooperation with the Directorate-General for International Cooperation of the Ministry of Foreign Affairs (DGIS). The purpose of these RAWOO Lunch Lectures is to intensify the communication between researchers and policy-makers and to offer a forum to discuss the policy implications of research and the research dimensions of policy issues.

In the last few decades the term 'knowledge-intensive society' ('kennisintensieve samenleving') has come to the fore in many Dutch national policy papers in the areas of education, science, economics and even home affairs. Does this also apply for developing countries and for development cooperation policies?

Although research and research capacity enhancement are solid components of Dutch development cooperation policy, the question of whether research outcomes are actually being used in policies is often raised, mostly during informal communications. Policy-makers argue, for instance, that they have no time to wait for the outcomes of research or that research generally does not focus on policy priorities. Researchers, on the other hand, blame policy-makers for not making sufficient use of the outcomes of their research, or for not taking the time to read them.

RAWOO believes that access to knowledge and knowledge production is a key element in processes of innovation and sustainable development. We were therefore pleased when DGIS accepted our proposal to explore jointly the issue of utilization of research for development cooperation by means of a series of RAWOO Lunch Lectures. The lectures were held in 1999 and 2000. In order to reach a wider audience the series was concluded with a seminar in June 2000.

We are pleased to present a report on these meetings in this publication. The lectures are presented in various forms: the entire lecture, a summary, the original paper on which they were based, or a paper drawn up later by the speaker, based on the lecture.

In addition to the speakers, to whom we refer in the introduction, we would like to thank all those who invested time and effort in preparing and organizing the lectures and the seminar, in particular Hannie Loermans, George Waardenburg, Fred van der Kraaij and Georg Frerks from the Ministry of Foreign Affairs. For reporting and editing work thanks are due to Peter Conradi of Wereld-in-Woorden (seminar report) and Andy Brown (language editing).

Gert van Maanen
Chairman, RAWOO

Introduction

Our natural environment, our society and the interaction between them are changing more rapidly than ever before. The influence of science and technology on this process of change has been growing at a tremendous speed.

The effects of these changes have not been positive for everyone, everywhere. On the contrary. Notwithstanding the remarkable technological achievements of our time there is a growing number of people, mainly in the countries of the South, who are negatively effected by processes of change and environmental degradation, resulting in severe impoverishment and social exclusion. To assist the countries of the South in their efforts to put a stop to this and to benefit from the new global opportunities is a major challenge for development cooperation. In RAWOO's view, science and technology will play an integral part in these efforts.

Since its establishment, RAWOO has pointed to the vital role of scientific research in development cooperation. In this context it has identified many priority research themes; it has addressed issues of research capacity and of research cooperation, including by developing new ways of establishing genuine North-South partnerships which focus on the South's own development priorities.

The efforts have more or less implicitly taken for granted that investing in research will ultimately pay off for the developing countries involved, but there has been a growing awareness that the relationship between research and development policy and action is not straightforward and therefore not obvious to everyone. Although recent policy documents, like the World Bank's 'Assessing Aid', clearly make use of research findings, policy-makers are often very persistent in questioning the usefulness of scientific research. Researchers, on the other hand, often accuse policy-makers of ignoring existing outcomes of research, or of starting new policy initiatives without thorough research preparation. In addition to this, researchers from the South often express their concern about the low priority given to scientific research in their countries.

In the context of RAWOO's efforts to find ways to link development research more closely to development policy, questions related to the utilization of research have also come up frequently: what is the societal impact and/or relevance of the research, how are results disseminated to potential end-users, how do end-users participate in the research, what is the societal quality of the research, etc.? The many stakeholders dealing with research use different languages and concepts and have different perceptions of the subject. The fact that there are so many different notions of the role of research in development thinking and practice was reason for RAWOO and the Directorate-General for International Cooperation of the Dutch Ministry of Foreign Affairs (DGIS) to organize a series of lunch lectures on this subject, with the aim of acquiring the latest insights in this field.

During the preparations for the series and the discussions about whom to invite as keynote speakers, it emerged that the subject matter is particularly complex in a development cooperation context, where so many different development approaches and policy levels are involved and where so many different disciplines have developed their own approaches to research, dissemination and utilization. Where the choice of potential speakers was concerned, rigid categories like 'applied', 'fundamental' and 'strategic' research, etc., were soon abandoned, giving way to a more creative approach of inviting those who could introduce the subject from a new or different perspective. We were keen to know whether we could shed new light on the issue of utilization by allowing people with totally different perspectives to tell of their experiences. For instance: what can be learned from comparing a specific technology research programme in the Netherlands with the story of a person working with the poor in the slums of Mumbai, and how does this relate to the view of the World Bank?

Our aim with this series was not to 'invent' a new truth on the subject matter, but to promote interest and, if possible, a new dialogue between the science and development communities. We asked the speakers to address general questions in the context of their specific situations, e.g.:

- What is the role of scientific knowledge in development policy and practice?
- How and when are the outcomes of research being used and by whom?
- Is there a need to enhance utilization of research?
- And, if so, how can this be realized?

In order to answer these questions in specific situations we invited keynote speakers from a wide range of disciplinary, institutional and geographical backgrounds:

- Arie Rip and George Waardenburg introduce the subject matter from a more or less theoretical point of view: Rip from a science of science perspective and Waardenburg from his position of Chief Scientist at the Ministry of Foreign Affairs.
- Joske Bunders , Frans van den Beemt and Guus Berkhout elaborate the subject from their practical experience in different Dutch-funded research programmes. Bunders focuses on the end-user perspective of poor farmers in Bangladesh. Van den Beemt deals with cooperation between the science community and the private sector in the Netherlands on primarily technological research. Berkhout approaches the problem from his experiences with improving the link between technological research and the innovation process.
- Lyn Squire accepted our invitation to present the view of the World Bank on research as presented in the World Development Report 'Knowledge for Development'.

Three speakers were invited from developing countries. All three look at different perspectives that have, until now, been largely ignored:

- Arjun Sengupta looks at research utilization from the perspective of the National Planning Commission of India.
- Sheela Patel, also from India, explains how the slum dwellers' negotiating position with the government changed after they conducted their own research project.
- Sonia Montaño Virreira broadens the scope of research utilization to embrace questions of autonomy and capacity.

RAWOO seminar

In June 2000, in order to underline the message of the RAWOO Lunch Lectures for the policy dialogue between researchers and policy-makers, the series was rounded off with a seminar aimed at a larger audience. We particularly draw your attention to the report on this seminar, which was very well attended.

To facilitate the discussion during the seminar, RAWOO commissioned a literature review on the subject of utilization. The resulting paper, including a bibliography, was prepared by Jack Spaapen en Frank Wamelink and is included in this publication as an annex.

The seminar was also a tribute to George Waardenburg on the occasion of his retirement. As many people know, George has always been very dedicated to the real benefits that development research should have for developing counties. We therefore specifically draw your attention to his epilogue.

As we can see from the contributions and the attendance rate of the seminar, development professionals have a keen interest in the subject of utilization of research. New 'modes of knowledge production', to quote Michael Gibbons, 'in which the worlds of difference between science and society are gradually changing' are being discussed. Also, new North-South partnerships are emerging, in which grassroots organizations, scientists and policy-makers are showing an emerging interest in and commitment to serious cooperation and dialogue, which will break ground for new partnerships between end-users and researchers in both the North and the South. We hope that this publication can be of help to those who are interested in making development research more relevant to the poor in the South.

Lectures

The utilization of research results at the Ministry of Foreign affairs: points of departure

Introductory lecture by George Waardenburg

What exactly constitutes 'the utilization of research results' is a question to which no one simple answer can be given. It is not the logical extension of a linear process leading from fundamental research, through fundamental-strategic and applied research, to the dissemination of results. One cannot therefore take for granted that making research results more widely known or clearer to potential users (the 'rainstorm' model) will automatically mean they will be utilized to a greater extent.

In many cases, potential users must search actively (the 'fishpond' model), perhaps assisted by the mediation of individuals or organizations (such as consultants or documentation services), as described by Van der Meulen and Rip.[1] The importance of an active search process is suggested by the results of a study conducted by Ms F. Knoet at the Directorate-General for International Cooperation (DGIS) a few years ago.[2] The study revealed that only about half of the research results intended for utilization by DGIS were actually being used. Not only that, but the decisive factor favouring application turned out to be whether the research had been conceived within DGIS itself.

There is a difference between science and technology on the one hand, and the social sciences and humanities on the other, where it comes to the utilization of research results: in the exact sciences, research culminates in fairly concrete applications, while other types of research lead to more diffuse situations in which it is hard to say for sure whether the results are actually being utilized or not.

An example of this difference presented itself during the preparation of a one-day seminar on security research that was recently organized jointly by the Ministry's Security Policy Department (DVB), Conflict Management and Humanitarian Aid Department (DCH) and Strategic Policy Orientation Unit (SBO). The reason for organizing the seminar was that the Ministry's ties with security researchers, which had been very close at the time of the cruise missile debates of the 1980s, had weakened considerably since then. This was not the case at all with researchers working in the exact sciences who, because of the well-defined need for research on subjects such as landmine detection and chemical weapons, had simply carried on working as before. Furthermore, in the public eye, society is more profoundly influenced by science and technology than by other disciplines.

The following introductory remarks therefore chiefly concern the 'non-exact' sciences, although the article by Van der Meulen and Rip already cited indicates that the utilization of research results in the 'exact' sciences too is not entirely unproblematic.

Knowledge creep

While considering ways of encouraging the utilization of research results in our own ministry, we came across some interesting work by the American researcher Carol Weiss. In her article 'Knowledge Creep and Decision Accretion', she points out that research results are not in general delivered to policy-making institutions explicitly, as if delivered by mail, nor do they have any very obvious visible impact on important policy decisions.[3] She explains:

'... research knowledge usually affects the development and modification of policy in diffuse ways. It provides a background of empirical generalizations and ideas that *creep* into policy deliberations. Its influence is exercised in more subtle ways than the word "utilization" - with its overtone of tools and implements - can capture.'

'... many policy actions, even those of fateful order, are not "decided" in brisk and clear-cut style ... In large organizations, policies often come into being without such systematic consideration. No problem (or opportunity) is identified as an explicit issue, no identifiable set of authorized decision-makers meets, no list of options is generated, no assessment is made of relative advantages and disadvantages, no crisp choice is made. Yet the onrushing flow of events shape an accommodation - and a pattern of behaviour - that has widespread ramifications ... Without conscious deliberation, the policy *accretes*.'

The kinds of situations described here scarcely need any amplification with examples, as they are familiar to us all. Who, from this ministry, can remember ever seeing a specific research finding that was available as a ready-made, take-it-or-leave-it option during policy planning? Louk Box once commented that, at best, research results are simply part of the constant stream of information contained in official government reports, reports from international agencies, items in the media, verbal communications at meetings, all of which policy planners take into account - and indeed should take into account. In this 'competitive market', research results often have the

1. Meulen, Barend van der, and Arie Rip, 'Science policy and utilization of research: key concepts and insights', background paper, conference of like-minded research donors on 'Societal Direction and Impact of Development Related Research', June 1994. Directorate-General for International Cooperation, Ministry of Foreign Affairs of the Netherlands, The Hague, 1994.

2. At the time, Ms Knoet was a student at the Centre for Development Planning at the Erasmus University Rotterdam. She did this study under the supervision of the author.

3. Weiss, Carol H., 'Knowledge creep and decision accretion', in *Knowledge, Diffusion, Utilization,* vol. 1, no. 3, March 1980, pp. 381-404.

disadvantage of non-specificity, of not being tailor-made, and they are often hidden away in somewhat turgid publications; furthermore, different studies will sometimes appear to contradict one another.

That policy decisions take shape gradually, and allow little if any scope for the visible utilization of research, is something that is as well known to ministry staff as it is frustrating to researchers' egos or their sense of achievement.

Seven models of utilization

In another article, Carol Weiss discusses what she calls 'the many meanings of research utilization'.[4] Further study shows, she believes, that the utilization of the social sciences in government policy is a highly complex phenomenon that is regarded in an enormous diversity of ways.

4. Weiss, Carol H., 'The many meanings of research utilization', in *Public Administration Review,* September-October 1979, pp. 426-431.

The first image she mentions is the *linear model*, with *fundamental research as the driving force*, which is largely rooted in the natural sciences and has a more tenuous hold on the social sciences: policymakers will be less inclined to utilize research results that come to their attention if they do not tie in with a problem that they have themselves already identified or recognized.

The second model is that of *problem solving*: a policy problem is assumed to have been formulated as such, and research is expected to find the missing pieces of knowledge for a new approach or solution, whether by drawing on previous results or by pursuing a fresh line of enquiry.

Weiss points out, however, that for research to impact on policy decisions in this way, a large number of factors must be present simultaneously: '... a well defined decision situation, a set of policy actors who have responsibility and jurisdiction for making the decision, an issue whose resolution depends at least to some extent on *information*, identification of the requisite informational need, research that provides the information in terms that match the circumstances within which choices will be made, research results that are clear-cut, unambiguous, firmly supported and powerful, that reach decision-makers at the time they are wrestling with the issues, that are comprehensible and understood, and that do not run counter to strong political interests. Because chances are small that all these conditions will fall into line around any one issue, the problem-solving model of research use probably describes a relatively small number of cases.'

Thirdly, Weiss describes the *interactive model*, in which policymakers gather their information from a variety of people and sources, within and outside their own institution, including social scientists. As she puts it, 'The process is not one of linear order from research to decision but a disorderly set of interconnections and back-and-forthness that defies neat diagrams ... Social scientists are one set of participants among many. Seldom do they have conclusions available that bear directly and explicitly on the issue at hand. More rarely still do they have a body of convergent evidence. Nevertheless, they can engage in mutual consultations that progressively move closer to potential policy responses.'

Sometimes research is used to bolster a position that has already been adopted beforehand: this is the *political model*, which, unscientific though it may appear, can represent a serious approach all the same.

A close relative of the political model is the *tactical model*, in which research is used to postpone a decision, to smother criticism with scholarship, or simply to give the decision or decision-maker a certain *cachet*. This goes beyond the limits of acceptability for researchers, but it is nonetheless common practice.

The sixth model defined by Weiss is the *enlightenment model*. 'Here it is not the results of a single study nor even of a body of related studies that directly affect policy. Rather it is the concepts and theoretical perspectives that social science research has engendered that permeate the policy-making process'. Weiss herself points out that while this model offers some comfort to researchers in the expectation that their efforts have somehow been effective, the general conclusions it yields are often subjected to too little critical assessment, and are scarcely an efficient means of reaching policy-makers, let alone of convincing them.

The seventh and last model discussed by Weiss is one in which research and its utilization are seen not as something quite separate, but as belonging to the gamut of a society's intellectual activities. Research can help solve problems that have already been defined, but it can also help identify problems or reformulate them by opening up new perspectives.

In a nutshell, these seven views will have struck many people in this room as containing realistic elements, without any one appearing to have a monopoly on the truth. This enumeration liberates the shaping of policy for the utilization of research from any need to adhere rigidly to a single model. Instead, each model should be looked at critically, and their individual strengths combined.

Social functions of research

When reflecting on what constitutes the utilization of research results, it may also be useful to distinguish between three social functions of research in the social sciences, as was done in the 1992 policy memorandum on research and development cooperation.[5]

- An important function of research is to contribute to the quality of debate in society by providing general principles, concepts and problem identifications, furnished with sound arguments.
- Its second function - which is indeed widely regarded as its only function - is to turn out concrete solutions to concrete problems.
- The third function is to show how a situation is likely to develop according to whether or not a certain policy is followed.

It would exceed the bounds of this brief introduction to give detailed examples of each of these three functions. Recalling Weiss' seven models, we might note that each focuses on one function more than another. The significance, for policy-making, of the first of these functions, in all its vagueness, should not be underestimated. Keynes pointed out, for instance, that much economic policy has been spun from obsolete economic theories. The third function too has a great impact on policy, for instance in conflict research.

Types of knowledge

It can also be useful to distinguish three types, or levels of abstraction, of knowledge:

- Concrete and accurate data on situations and developments is often very important to prevent policy misfiring through unfortunate actions or omissions.
- Pointing up connections between phenomena is the nuts and bolts of research in the social sciences, and of enormous benefit to intelligent policy planning.
- But research also contributes conceptual analysis, in-depth critical examination of ideas, problem perceptions and expectations, all of which can greatly enhance an open and visionary policy.

It is important to distinguish between these three levels of abstraction, on the one hand because research results are communicated and absorbed differently at each level, and on the other hand because the kind of effort that is required within a policy-making institution to use results is completely different at each level.

How can utilization be stimulated?

Finally, there is the question of what can be done with these principles, conclusions and distinctions, in an effort to stimulate the utilization of research results within the ministry.

A point of practical significance: not only have senior ministry officials been expressing an interest in efforts of this kind for years, but a recent series of talks with various departments yielded a similar strong interest, albeit less consistently.

For the rest, it is worth noting that the Ministry is already using research results in many ways, whether directly or indirectly. The enabling conditions for it have been created, for instance by the existence of advisory councils for policy, the Strategic Policy Orientation Unit, and an excellent documentation service.

What chiefly emerges from the points of departure outlined above is the realization that the ministry can only utilize research results if it devotes careful thought to defining the precise areas and problems in relation to which it expects research to make a contribution. This is in effect close to the problem-solving model, though with a wider range of application than that indicated by Weiss.

The effort to boost the utilization of research results is heavily reliant on the interaction or 'fishpond' model, in that it involves fostering direct ties between researchers and policy planners, who will meet in small problem-centred discussions, workshops, conferences and symposiums, always on the basis of a thorough preparation of the subject-matter and literature within the ministry beforehand.

5. This distinction in the policy memorandum 'Research and Development Cooperation' of the Ministry of Foreign Affairs, DGIS, actually goes back to the final report of the ad hoc committee Methodiek Ontwikkeling Sectorraden (Development of Methods for Sector Councils), published in the early 1980s by the Ministry of Education and Science in the Hague.

At the time of the lecture (1-9-1998), Professor J. George Waardenburg was Chief Advisor on Research Policy at the Ministry of Foreign Affairs and Professor of Development Economics, Erasmus University, Rotterdam, The Netherlands.

At the same time, Dutch researchers are to be drawn into the effort to make research results more accessible. First, they will be asked to write summaries of their publications, detailing the problem that their paper tackles, the results, and the significance they themselves attach to the results for development policy, and more specifically to development cooperation policy, as pursued both by government and non-governmental organizations. Another plan is to commission researchers to produce overviews of important literature of specific relevance to a particular policy.

From both sides, research and policy, this will call for an extra effort and above all, more concentration. But the expectation is that this effort can be effective in the context of a sound policy, and that it will add depth to policy while enlivening research.

Utilization of research: a sociology of knowledge perspective

Arie Rip

I would like to start with a question: did you know that you can get depressive from working on the Internet? It was an item in a number of Dutch newspapers. I did not actually read the item myself, but people told me about it. And now I am telling you.
Clearly, knowledge from research is utilized here, but not in a straightforward, instrumental way. This introductory example may be anecdotal, but readers will recognize it as something which happens all the time - and which may be more important than direct utilization. In other words, the utilization of research results is diffuse: it contributes to a repertoire of orientation in the world, of signals to take into account, in addition to the more recognizable production of specific knowledge with an instrumental function. This is not limited to ordinary citizens drawing their information from newspaper items or hearsay. Scientists, when questioned about the sources of knowledge about new developments in their fields, put professional magazines rather than scientific journals up front, and are interested in non-professional reporting about science as well.

If uptake and utilization are diffuse, people will often not realize where they got their knowledge from. The head of the Criminological Research Unit at the British Home Office (a member of an Economic and Social Research Council working party on the impact of social research) told of administrators coming up with bright ideas which they considered to be their own - but which were actually traceable to research from the Unit.

What these examples indicate is that knowledge utilization does not occur as tidily packaged bits of knowledge being transmitted, and then recognized for their value and taken up in policy and practice. It is, to use Carol Weiss' phrase, 'knowledge creep'. And its complement is 'decision accretion', the gradual accumulation of bits and pieces (including orientational and instrumental knowledge) which prepares the ground for what is then stamped as the official decision.
What I am trying to demonstrate is that the utilization of knowledge in policy (and in practice) is not a singular relation between an identifiable knowledge source and another identifiable decision in the world of action. These are really the tips of two icebergs - which may actually be linked underwater. To understand what is happening, one has to know about these icebergs and their linkages.

Complexities of knowledge transfers

We should add to this the distance between research conducted in relative isolation (in laboratories and institutes, and often in donor countries rather than developing countries themselves) and the practices of actual and potential users. A complex picture emerges of precarious linkages between various practices - of research, of policy-making, of local practices and the knowledge production involved. This is shown in diagrammatic form in figure 1.

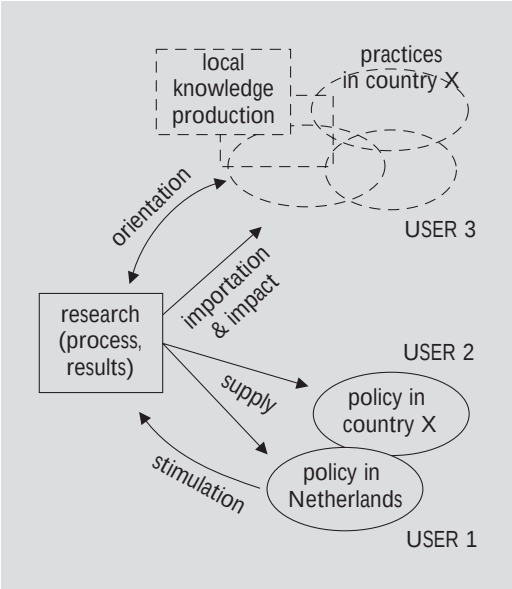

Figure 1: Transfers of knowledge

Research, in the way it is conducted and in the form of its results, may well orient itself to the issues and problems important in a specific country (country X), but will have, almost by its nature, a certain distance from local practices. It is policy-makers and their staff who are the more accessible users (in the Netherlands, the users of such research are interested in eventual utilization in policy and practices in country X). Local practices are then a reference point, rather than locations of uptake. Research results may be transported into such practices, and have impacts, but the projected beneficiaries will not necessarily be happy about it.

This is a brief, much too brief, sketch of a complex set of interrelated problems. Figure 1 also shows that there are gaps and/or tensions: between the policy level (with users 1 and 2) and the practices in specific countries (with users 3), and between established modes of research and local knowledge production. Both types of gaps are now recognized for what they are, but there are no easy solutions.

As is well known, there are communication problems between (established) knowledge producers and policy-makers, and in another vein, with local practitioners. In the literature, these problems are often characterized as a 'two communities' problem: researchers form a community of their own, with its own language and rationality, which is different from the community of policy-makers (or of practitioners). While the diagnosis is correct, the commonly proffered solution, better communication, is insufficient.

It is insufficient on two counts: communication is not ad-hoc, but requires a communicative infrastructure; and (cognitive) translations between local and general are necessary. Research findings always aim at a certain generality: of methods which are applicable in a number of cases, of results which are valid for a larger domain. This is what makes research findings interesting and applicable in other cases elsewhere. Utilization, however, is concrete and locally specific. Thus, utilization requires translation: cognitive translation, to a form and a content which is applicable, and social translation, from the locus of production (or storage) to the locus of utilization. Locally specific research tries to include these translations in its design and its ongoing work, but will still be linked with more general, cosmopolitan achievements through its use of general methods and skills of the researchers.

Effective communication requires ongoing interaction and trust, as well as relevant infrastructure. Examples are collaborative networking (if the right capacities are there), partial codification of knowledge, and people (embodied knowledge) moving about.

Modes of knowledge production

The utilization of knowledge must be seen as a double translation: at the site of knowledge production, translation from local to general, and after transport of the knowledge, adoption and adaptation, the translation of the general to the specific. The transformation of local experiences to findings with a cosmopolitan status is an essential ingredient of the scientific mode of knowledge production: it is the basis of scientific claims of universal validity. I am introducing the idea of 'cosmopolitan' here to refer to the circulation of what originated as local knowledge and having some validity in other places and times, without having to assume its inherent universality. Such transformations are not limited to the specific mode of knowledge production of modern Western science.
Professional forms of knowledge are one example, while craft knowledge and folk knowledge can also fall under this rubric.

The local-cosmopolitan combination typical for modern (Western) science is often seen as the answer to the challenge of creating cosmopolitan, transportable knowledge, where the ascent from local to cosmopolitan is what counts. As practitioners of science very well know, this requires interaction and infrastructure (from visits to other laboratories, partial standardization of conditions to improve replication, to codification of measures and protocols), and the utilization of such cosmopolitan knowledge is conditional on the existence or build-up of the relevant infrastructure. The ideology of universal knowledge claims and the generalized applicability of modern (Western) science neglects what happens locally, however. This is already a problem for Western science itself because the quality of cosmopolitan knowledge depends on what happens in the local situation. An additional problem is that the return route, from the cosmopolitan to the local, is seen as unproblematic (because whatever has become cosmopolitan must be good, so that any problems must reside in resistance of the local to the good message from the cosmopolitan). In other words, the translations necessary to return to the local are neglected as epistemic challenges in themselves.

The translation back to the local is easier if the context in which research results are taken up resembles that of the research process. The controlled conditions of production in chemical plants, for example, as well as the chemical specification of the feedstocks, allow the easy transfer of laboratory findings to chemical production practices. But this is a historical achievement, based on a variety of efforts (partly driven by economic and political circumstances) in the late 19th and early 20th centuries. And the achievement depends on the transformation of industrial practices, to make them more like the controlled experiments in laboratories. A similar trend is visible in agricultural research, where the applicability of experimental studies is predicated on the transformation of agricultural practices, and of the land itself, into something resembling laboratory conditions. Seen in this way, there are clearly advantages (productive set-ups) and disadvantages (distortion of earlier practices, the neglect of side-effects).

Thus, there is a colonial element in utilization of research, if the original context of knowledge production dictates the circumstances of its application. This is not intended as a blanket indictment, however: colonialism had its positive side. But it leads to unnecessary neglect of the knowledge accumulated in local practices; transfer of knowledge is never from 'full' to 'empty'.
To provide a balanced view, I would like to introduce a typology of modes of knowledge production which become independent of local practices and then have difficulty in linking back to them (see figure 2).

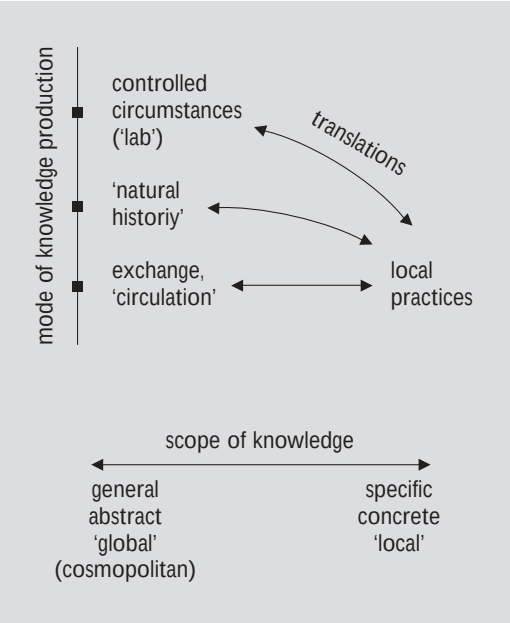

Figure 2: Modes of knowledge production

The sketch in Figure 2 could be filled out further, but it is sufficient to understand the examples of the chemical industry and agriculture which I mentioned above. It could also be applied to the tensions between practical medical diagnosis, clinical research (an attempt to transform the pattern knowledge produced in the natural history mode to experimental knowledge with the help of clinical trials) and so-called pre-clinical research in the experimental approach predominant in natural sciences.

When the local situation and its complexities are given precedence, the drive to change the world so that it resembles the laboratory has to be reversed. For the philosophy of knowledge, as well as for practitioners of various kinds, the challenge is then to make natural-history modes of knowledge production more robust without going in the direction of experimental, laboratory-based science, with the consequent distance to other types of local practices. As the philosopher Ian Hacking has phrased it: experimental science is lab science, and can tell us a lot about the lab world. The complexities of the world outside the lab may well be outside its reach. The movement for evidence-based medicine, and the second thoughts about its actual scope which are being voiced recently, provides a useful example, and one that can be recognized in the reflections on transfer of modern scientific insights into local practices in less developed countries.

Replacing the linear model

My arguments for considering two-way traffic in modes of knowledge production rather than the top-down elaboration of lab-based experimental research have focused on the cognitive or epistemic issues. There is a sociological component as well, and I would like to highlight one key element by discussing, what is called the linear model in innovation studies and science policy studies. The linear model suggests that the dynamics go from a source (new knowledge, new options) through its elaboration to eventual adoption, diffusion and effects. The top-down model is a version of the linear model because it says that one can transfer only by somehow transforming the complexities of the situation so that the cosmopolitan knowledge becomes applicable. (It does, however, make explicit the work necessary for utilization).

As sociological and management studies have shown abundantly, the linear model is really an extreme case of a more general, interactive model. I add the dynamics of cosmopolitan knowledge production to the interactive models in the literature, which results in a three-part interactive model, as visualized in figure 3. Each part indicates typical activities, which are linked through a diffuse 'reservoir' at a more collective level. This linkage-through-reservoirs can be short-circuited in strictly goal-oriented research, and in dedicated applications, to a quasi-linear model, but even then there will be spin-offs into the reservoirs.

In the first part of the model, the activities are oriented towards research agendas and resource mobilization. There is negotiation on the market of promises and options, very visible in the world of strategic research, but always present. The effect is that a repertoire of anticipations (about the relevance of various research projects and directions) emerges and is continually added to.

This repertoire provides feedback to the strategic decisions of scientists, the sponsors of science and, increasingly, prospective users and beneficiaries (cf. the mutual orientation of (separate) research and local practices, indicated in Figure 1). Explicit priority setting for research occurs against this background, and is actually successful only when it accommodates itself to the repertoire or consciously orchestrates a change.

The activities of knowledge production in the second part of the model are not limited to the creation of packaged research results on the basis of laboratory or fieldwork. There is already some communication with trusted assessors, with comcolleagues (competing colleagues) who may be the reviewers of the research results etc. There may be immediate, 'linear' uptake in practice, but the general effect is an addition to what has been called 'the pool of knowledge' - in which others (researchers, practitioners, journalists) can fish.

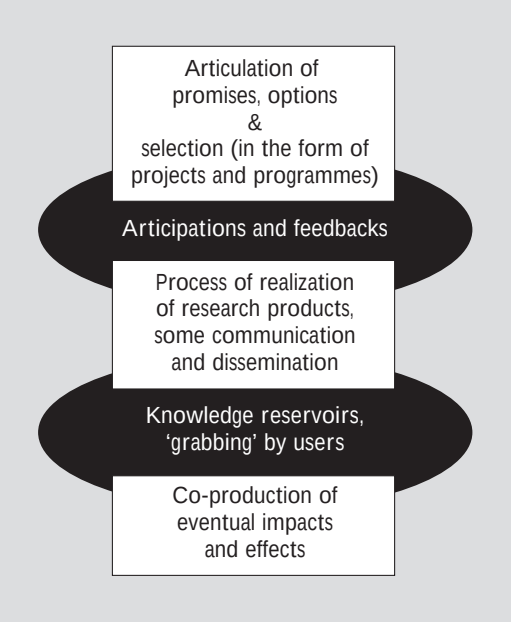

Figure 3. Three-part interactive model

The various and overlapping knowledge reservoirs are accessible to different potential users in different ways, in terms of their absorptive capacity and competencies for translation which I discussed above, and for other reasons. Still, whatever utilization occurs in the end is not a matter of the force of the research results, but of how users 'grab' items from the knowledge reservoirs and combine them for their own purposes. They are agents, not patients.

The third part of the model relates to the activities which turn a novel combination of knowledges into a going concern, as part of practices, as a component in a successful innovation, as an element in decisions and their implementation. This is how the effects originally promised are actually realized. As I emphasize in figure 3, such effects are co-produced, and the attribution of impacts to sources (causes) within the world of science is indeed the result of a struggle to apportion praise and blame. Jerry Ravetz once noted: 'Science takes credit for penicillin … but Society takes the blame for the Bomb.'

In conclusion

The key points in this brief sketch of a perspective based on insights from the sociology of knowledge are the emphasis on activities (also on the part of prospective users), on the work that must be done to transport and translate knowledge between practices, and on the cosmopolitan character of knowledge (or better, a cosmopolitan-local aggregate); and the function of repertoires and reservoirs which undermines any simple linear picture.

The current striking, and increasing, role of information and communication technologies will be embedded in these interactions and patterns and derive their effects from them. They will also modify them, for example when databases and geographical information systems (GIS) require sharper definition of categories (an 'ontology') at the cosmopolitan level.

This last example is interesting also for the issue of combining distantiated research and local, perhaps traditional, knowledge production. In a number of examples, one sees GIS and other databases taking up local data of a natural-history type, and sometimes modifying categories or even rules to suit local and traditional usages. This shows that the combined, syncretic use of knowledge produced in different practices and following different modes is possible if adequate structuring is developed. This might well be an important cognitive challenge for issues relating to utilization of research.

The other main challenge is to increase the capacities and underlying competencies of local actors to access knowledge reservoirs and 'fish' in them productively. Development aid, whether to less developed countries or in the form of scientific education and public understanding of science in

the own country, has a built-in asymmetry. This may be acceptable in so far as the knowledge on offer is indeed relevant to the local situation. But this is not automatic, and it requires active participation from the local situation to realize its promise. We might then also accept other promises and claims, deriving from the local situation, as legitimate in principle.

These points about utilization of research cut across the present policy emphasis on research being oriented to use and users, and showing its 'performance' in this respect. There might be occasions where such policy pressure has a function, when earlier ways of conducting research have to be changed. But there is a definite risk: a continuing pressure of this kind will linearize interactive practices and limit the scope of the research, as well as the variety in uptake by 'fishing' in knowledge reservoirs. Instead of research becoming more directed (and thus directive with respect to local practices, because it must prove its usefulness), I emphasize the pro-active role of the user, and the necessary competencies to go with it.

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The use of academic research for technological development[1]

Frans van den Beemt

1. Paper based on the lecture

Introduction

The focus of this paper lies on academic knowledge transfer: the transfer of knowledge from university to society. In the field of technological research, industry often acts as an intermediary to ultimate use in society. This is less common in the social sciences where - instead of industry - individuals, groups and/or states are involved as users. I will refer only to the field of technological academic research.

During the technological academic research phase the actors involved - universities and industry - play the most important role in what can be called the early innovation process. I will first discuss six factors which are important for knowledge transfer during this process. Then I will address the following questions: How can we fund the right research proposals? How can we speed up the innovation process? What have we learned from the practices within the Dutch Technology Foundation (STW)?

Factors relevant to knowledge transfer

The following six factors are relevant:

- the source of original ideas for realized innovations and the role of 'champions' in the actual academic knowledge transfer process;
- the role of university and industry;
- networks;
- fees for companies;
- direct transfer;
- intellectual property rights.

The source of ideas

An early innovation needs good ideas, motivated actors and, last but not least, commercial awareness. The word 'commercial' must be regarded as a positive condition to guarantee ultimate use in society. The source of good ideas can be mainly university-related, industry-related or both. In the USA, UK, Sweden, Switzerland, the Netherlands and many other countries, governments have set up programmes for academic research with the criterion of funds being matched by industry. In many cases this stimulates the involvement of industry in formulating research agendas. All around the world governments stress the importance of industry in deciding what is relevant. Examples are the Technology Top Centres of Excellence (TTI) and the Innovative Research Programme (IOP) in the Netherlands, the Grant Opportunities for Academic Liaison with Industry (GOALI) Programme, the Engineering Research Centres Programme and the University-Industry Research Relationships Programme of the National Science Foundation (NSF) in the USA, and the EU Framework Programmes.

Many managers within government, industry, research institutes and research councils believe that ideas for innovations tend to come from industry: industry poses problems that require theoretical understanding through long-term research. These managers find that professors generally become more and more conservative over time and tend to stick to certain subjects. However, I have not have seen many well documented studies that support this view. On the contrary, there are research results that reach opposite conclusions: that ideas for new products come from scientists not from industry, and that significant innovations have a linkage with academic research or with basic research performed in laboratories in industry or in federal research institutes (Kruytbosch, 1979; IRI, 1979; Hameri, 1997; Van den Beemt, 1997; SPRU, 1997).

This is in line with the experience of the Dutch Technology Foundation (STW). STW, founded in 1981, was intended for the four Dutch Technical Universities which until then had difficulty obtaining funding from the Dutch Scientific Research Agency (formerly ZWO, now NWO). The applied nature of their research was regarded as inferior to the fundamental research performed at the non-technical universities. STW was the first Dutch research agency especially for applied academic sciences. It is open to all thirteen Dutch universities and, to the astonishment of many people, half of all applications came (and still come) from the non-technical universities. Certainly in STW's early years the researchers had far fewer contacts with industry than today, and the ideas for their research must mostly have been their own, driven by curiosity. Interestingly, STW's retrospective utilization reports, drawn up six years after research projects have been completed, show the same good results in terms of breakthroughs and commercial use no matter from what kind of university the projects originated.

This does not imply that good initiatives and ideas cannot start within an industrial setting as well. It only shows that university researches do not per se need the help of industry in formulating and generating new ideas that have the potential for breakthroughs in the long run. The situation is rather that innovations need a heavy R&D and marketing involvement by industry. Industry

realizes the innovation, not the university. *The university delivers the essential ingredients and industry does the lion's share of development work and marketing*. It is not uncommon for industry to spend ten to a hundred times more on research than universities. It is therefore no wonder that industrial managers and many others in government are not aware of the essential role played by universities. At the same time industrial managers find it very hard to select new ideas for large investments. The problem they face is similar to what research councils have to deal with. There are many good proposals but all are highly risky and uncertain. Here the role of the 'champion' is important.

Champions and commercial awareness

The role of champions in industry is a well-known phenomenon. At each stage of the process a champion can come forward to support an idea at the risk of jeopardizing his own career. The lack of reliable criteria for the selection process strengthens the role of individuals or champions. Rubenstein (Rubenstein *et al*, 1997) suggests that there are two champions needed: one on the R&D side who believes in its commercial application and is willing to risk personal problems in order to see it transferred outside R&D, and one on the business side, a manager willing to sponsor, fund and defend the conversion effort, 'a fanatic with money', who has foreseen a successful product, who has the will and resources to see it through.

Academic research also has its champions, people who are motivated to show the public the relevance and potential for the future of new scientific knowledge. Their predictions are often right on the mark. Kruytbosch (Kruytbosch, 1979) made an analysis of major innovations in four fields of technical science between 1950 and 1976. He found that 43% of the cases were well predicted by the main researcher in the proposals selected by the NSF. STW has had the same experience (Van den Beemt and Van Raan, 1995a, b; Van den Beemt, 1997). In academic research proposals competence and originality go hand in hand. *As the principal investigators are the drivers of the early innovation, you may expect that many of them will act as real champions in knowledge transfer.*

Principal researchers are nowadays well aware of society's needs and scientific options. Commercial awareness is also greater today than it was only 10 to 15 years ago (see Marcy and Kosloski, 1982; Rosenberg and Nelson, 1994; and Nelsen, 1998). Commercial awareness can already exist in the early academic research phase of the innovation process. At STW, proposals are explicitly assessed for utilization potential, which carries equal weight to scientific excellence. It is striking that scientists (principal investigators) who are regarded by their (six) peers as outstanding and highly scientifically competent, are at the same time able to convince their peers and the jury of the commercial awareness for the long term.

The roles of universities and industry

Universities and industry must fulfil complementary roles. Universities must perform basic research and industry must perform applied R&D. The two partners must work together and not thwart each other. At STW, universities are not seen as places where development work must be done. This is safeguarded by the assessment process, in which two main criteria are used: scientific quality and utilization potential. The two assessments are made independently from each other and, as mentioned above, carry equal weight. Thus development work by the university will be assessed low on the scientific quality aspect, leading to rejection of the proposal.

The other situation, of industry doing a lot of basic research on the same topic, is less common within STW. Where a firm's basic research laboratory is involved, they prefer to work it out with one of their own business units. The danger of worthwhile internal knowledge leaking away prevents firms from involving a university as a third party. If only industrial basic research is involved and no business unit, then the industry itself faces a lack of utilization potential. The result will be low on the assessment of utilization potential, leading to rejection of the STW proposal.

The Government-University-Industry Research Roundtable, in conjunction with the Industrial Research Institute (IRI), published a summary of interviews with seventeen senior industrial officials in the USA. The officials underscore that universities must continue to teach, to foster creativity and to advance the frontiers of knowledge through long-term basic research. They explain that this role creates the underlying structure for the nature of collaboration and the expectations that universities should have when entering into cooperative programmes with industry (IRI, 1991). Some studies show the importance of these complementary roles in a very direct way. A study on NSF grants compiled questionnaire-based

data of 229 joint R&D projects involving 219 companies and 27 federal laboratories, showing that complementary roles are likely to lead to a shortened technology path (Rogers and Bozeman, 1997). Other studies also subscribe the importance of separate roles (Garnsey, 1997; Hetzner *et al*, 1989; Atiyah, 1996).

Differentiating within universities between basic, fundamental, applied and strategic research is in fact contradictory to the role universities have to play. They are the locus where research in its purest form can be conducted, at the highest standard and in open discussion with other academic researchers. Research as performed in universities must by definition be academic. Other adjectives, such as 'applied' or 'fundamental', do not do justice to the scientific enterprise. Yet the existence of these different forms of research within universities is widely believed and acted upon by policy-makers within governments and research councils. The distinction is made in almost every scientific budget, priority programme and new initiative.

Universities deliver knowledge that helps industry to understand phenomena in general. They also deliver skilled people and as such university research can be of use for industry. The ideas for innovative breakthroughs are born within universities. It takes a long time and a lot of effort by academics to transfer the new knowledge to industry and get it accepted. Only a small percentage of academics are involved in this transfer process, mainly through personal motivation (the champions).

University research generates options, new possibilities and enhances knowledge and skills, in general and in particular for industry. University research must not become a substitute for industrial R&D. Industry finds it very difficult to commercialize these opportunities. New technologies need huge investments over a long time span. No one can guarantee a commercial success. The same difficulties emerge in relation to companies' own R&D laboratories. Thus it should come as no surprise that industry does very little with new scientific results.

It is common government policy to stimulate university research programmes by obliging industry to match funds and by initiating partnerships. There is a real disadvantage in these popular 'partnerships' with universities. The balance between the complementary roles can easily shift towards short-term profit. The UK's Realizing Our Potential Award (ROPA), for instance, is a 'fast-track' channel for awarding grants to people who have contacts in industry. The selection is based on the ability to attract support from industry, and much less on the highest possible standards of scientific research. Industry regards this kind of research as rather cheap and decreases its own investments in in-house R&D. Many social science researchers have studied this process and underscore the danger of the shift in the balance it represents (Jacobs, 1997; Garnsey, 1997; Atiyah, 1996; IRI, 1991).

An interesting example is the Swiss KWF (Governmental Commission to Stimulate Scientific Research) which finances research projects at Swiss institutes and universities (mainly the two 'Hochschule') under the condition of industrial participation and matching funds (50-50). An inquiry in 1986 revealed that in 58% of 73 KWF projects under study, Swiss industry made use of the results. In 64% of the projects one industrial partner was involved, and in 23% two partners. The research is geared to the problems of the companies involved and can therefore be categorized as a substitute for industrial R&D. The research topics are to a large extent set by the industrial partner(s). This can no longer be regarded as academic research of the highest scientific standard. Universities rarely approach KWF for funds because they prefer to keep their independence and their own agenda (KWF, 1989).

The matching of funds is applied as an important mechanism of government control on spending budgets. The willingness of industry to spend its own money on research programmes is seen by government as the strongest indication that funds are well spent in terms of application in society (via industry) and of economic growth. Another mechanism closely related to matching funds is asking fees for participation in particular networks.

There are, however, alternatives for matching funds and asking fees. STW involves industry in user committees and in a peer review and jury assessment system. The attractiveness of highly original research performed by internationally recognized individuals proves, in itself, to be enough to involve industry. The advantages of the complementary roles are fully exploited and the value of personal contacts as the main mechanism of transfer of knowledge is still widely acknowledged. In fact, a user committee can be

regarded as a network involving several representatives (researchers and managers) from quite different firms and organizations. This will be further discussed below.

Networks

Here we see an interesting phenomenon. Networking is a must to stimulate knowledge transfer and in doing so, knowledge transfer works best in a one-to-one situation. Both as a stimulating environment and as a facilitating one, it contributes to the achievement of an optimal result. Networks between industry and universities are important for industry to continuously update its own knowledge.

In STW's 18-year existence, a user committee has always been set up for each project, which then stays active during the academic research phase. User committees form the early network in the research projects and all the actors involved still see them as functioning effectively (see Van Caulil *et al*, *19*96). The Innovative Research Programme (IOP) of the Dutch Ministry of Economic Affairs has already adopted this instrument of user committees.

The importance of networks between university and industry was studied by the IRI in the USA. Interviews with seventeen senior industrial officials revealed that these networks are very important to industry. They provide the necessary interdisciplinarity that comes along with the process of realizing innovations. No company is large enough or smart enough to meet all of its knowledge needs itself. They prefer one-to-one research collaborations between a university and an industry scientist[2]. In the summer of 1997 there was an Internet discussion about a survey conducted by Coopers & Lybrand. One of the findings was that companies benefit most by going for the highest quality, by partnering with universities. Often, however, access to the networks is not free. Companies have to pay fees and this has its consequences.

Fees for companies

Paying fees to participate in academic research networks forms an additional obstacle for small and medium-sized companies. Firstly, they are hesitant to participate in networks which are not exclusive, such as the Dutch Centres of Excellence (TTI), the NSF Industry/University Cooperative Research Centres and the Innovative Research Centres (IOP), if competitors (particularly large ones) are present at the same time. Secondly, the contribution is often too high in relation to the return on investment, and the latter is uncertain. Thirdly, small and medium-sized companies often need their highly skilled personnel for day-to-day commercial activities.

Large companies in principle face the same problems but can defend these fees as investment in good relationships with the other actors (government, non-profit organizations and universities), as providing access to highly skilled students, as promotion of their activities and as an act of corporate citizenship. In practice, they conduct their really important R&D in-house. The fact that commercial outcomes are seldom reported is the first indication of this phenomenon. Examples are the NSF Industry/University Cooperative Research Centres and Engineering Research Centres (ERC, 1997), the Dutch Innovative Research Programmes (IOP), the European Union Third and Fourth Framework Programmes and many others.

It is a well-known fact that, in most fields, the greater part of the innovation process takes place within industry (see Rosenberg and Nelson, 1994). Therefore the motivation of industry to maintain relations with universities must be maintained by offering an option for the direct transfer of knowledge. This will be discussed below.

Direct transfer of knowledge

Companies rely a lot on other companies and subcontractors to gather the knowledge they need, but that is outside the scope of this article. Here the focus is on the use of academic research in new innovations, so that they can be further developed within industry or society.

Universities try to transfer new knowledge to industry by setting up Transfer Offices. Even at the NSF Engineering Research Centres, fulltime Technology Transfer managers are installed to coordinate all activities relating to industrial collaborations and marketing, and to actively attract new industrial partners (see ERC, 1997). The task of these offices is not limited to direct transfer of knowledge. They also facilitate patent filing and the formalization of agreements between university and industry. Concerning the task of stimulating knowledge transfer, these offices ignore the fact that the main transfer mechanism is one-to-one personal contacts between scientist and industrial researcher. Technology Transfer Offices are not the ultimate solution for fostering academic

2. These findings are confirmed in the interviews with D. Brand, chairman of the Federal Laboratory Consortium for Technology Transfer, in Washington DC, USA (Fall 1997), and at the Corporate Sponsor Meeting of November 1997 with Prof. Alden S. Bean, Director of the NSF Centre for Innovation Management Studies.

knowledge transfer to industry because they are too far removed from the action.

All Dutch universities have their own Transfer Offices. These do not, however, have a large effect on the transfer of knowledge. In practice, the staff of the Transfer Offices try to sell the results of past research projects. In general companies do not understand these outputs and do not take the time to get acquainted with them. As a result, they often make a negative decision and do not invest in such uncertain and long-term undertakings. STW's user committees, which operate during the active research projects, have a different set-up and achieve better results. In contrast to the way the Transfer Offices work, one-to-one contacts take place over a long period of time and a company gets accustomed to the options and possibilities. At the same time trust in the capabilities of the research group is built up. When companies start thinking of future applications, direct transfer comes into the picture. And possibly investment may follow. The trust is directly coupled to the continuity of academic research groups. Continuity of the research financed by STW is often an important point of discussion at user committee meetings.

If a company decides, on the basis of academic research findings, to invest in a long-term innovation process, it needs an assurance of the backing and assistance of the particular university research group. This is especially the case for the small and medium-sized enterprises.

Academic research is generic in nature. After publication, it can be used worldwide to underpin innovative work within industry. The NSF chemistry study by Marcy shows that it can take 16 to 25 years from the start of an academic research to the commercial use of results in industry (Marcy and Kosloski, 1982). These figures are in line with findings of the Dutch Sensor-technology Programme, but they are expected to vary by field of research (see Van den Beemt, 1997). I expect that in the case of direct transfer grounded on continuity of the particular university group, the lag time between the start of an academic research project and its commercial use in industry or the society can be shortened.

Intellectual property rights

Tax-payers want to see the profits from their investments flow back to their own country. But open publication makes the knowledge available to everybody. Tax-payers therefore also want to see some kind of protection of intellectual property rights. The *possibility* of acquiring exclusive rights on academic knowledge is important for companies (see IRI, 1991, Nelsen, 1998). This can be an extra stimulus to stay in close contact with academic research. But the way in which this is achieved can vary with the field of research, the area of technology and the strength of the company on the world market. Small and medium-sized enterprises in particular might prefer to see the open publication of results censored or delayed above the filing of patents. Filing a patent means revealing the ins and outs of an innovation option. It can trigger other companies around the world to concentrate on the new possibilities (see Harabi, 1995). Sometimes other companies can infringe patent rights without repercussions because a small firm does not have the financial backing for a long legal fight in court or may not even be aware of what is going on. How to establish exclusivity for a certain period is often part of the discussions during STW user committee meetings.

Making innovative ideas public by filing a patent cannot be regarded as an disadvantage where scientific publication cannot be held up. In fact filing a patent anticipates the filing of patents by others and that in itself can be of advantage to a company working on an innovation. It paves the way for a company to develop a new product without interference by patents filed by others. A patent or publication reveals only part of the knowledge; another very valued part will never be published and is in the heads of the researchers involved. The transfer of knowledge by hiring these skilled people, or by retaining close working relationships with them, is highly regarded (see EPS, 1997, Rosenberg and Nelson, 1994, Parker, 1997).

Exclusivity is not always needed and can sometimes even be counterproductive. There are situations in which sharing knowledge and new technologies is the only way to successfully launch an innovation. This can be the case with products that need worldwide acceptance. For example, many shipowners would not want a completely different propulsion system if it cannot be repaired or serviced by other shipyards throughout the world. Other examples can be found in the electronic consumer industries, where standards between the largest companies are highly appreciated and needed. Another variant is where especially high-tech start-up firms achieve the best

promotion by citing to and being cited in scientific publications instead of holding up publication. This might, for example, be the case with the introduction of measurement equipment based on completely new technologies that need substantial investment by clients (other companies). The successful use of this new equipment by different academic groups generates the necessary trust in its potential.

An inquiry in 1986 revealed that in 58% of 73 KWF projects, Swiss industry did make use of the results. Only 12% of the firms involved in the projects patented the results (KWF, 1989). This implies that patents are not the ultimate indicator for commercial utilization of academic research results. In fact filing a patent is not the same as realizing commercial use. The latter is a challenge in itself and still a long and uncertain undertaking. Nevertheless, the number of patents is used as a main indicator for innovation. Patents can be regarded as one of the factors in the transfer process. The weight or importance of this factor depends on the field of research or the industrial sector involved. What counts is the answer to the question: is the best suited property-right mechanism used? If so, this is a strong factor in the knowledge trajectory.

Funding the right academic research proposals

How can a small country like the Netherlands be excellent in all fields of research? Two percent of all research in the world takes place in the Netherlands, so what can we expect? To be excellent or even the best in the world, we cannot compete in every area of R&D. It is obvious that we should choose our most brilliant scientists and let them develop their talents to the full. They should be free to choose the R&D topics that interest and motivate them. They are the ones who will be able to gather elsewhere the necessary knowledge for a certain mission.

Does this bring us back to the seventies, when we funded only basic research, when to do applied research was the same as losing your scientific status? Not exactly: *basic research is the same as dormant applied research*. The difference with earlier decades must be that scientists are now willing to spend only a small part of their time thinking about the potential long-term (15 years or more) utilization of the R&D they are doing. We achieve the best knowledge transfer when we also are willing to involve people from industry or potential interest groups in our society in brainstorming about potential utilization.

Speeding up innovation paths

Knowledge transfer requires endurance. Potential users need time to get accustomed to new technologies. To speed up innovation paths you must involve potential users as early as possible. The resulting network is at the same time a feedback system, which makes most processes work well. But increasing the budget for a potential research topic or priority is not the same as accelerating the new inventions. We have to select the right people, not the topic. We must establish a culture of product ‘champions’. Budgets must not be an up-front allocation to certain selected disciplines. The focus should be on the right teams. Mostly more than one discipline will be involved. Let the network itself evolve over time and fund it. In practice I have observed that two or three different disciplines seem to work best at the centre of an academic network.

STW assessment procedures

When STW was established in 1981 it decided not divide its budget into separate compartments for different disciplines, but to opt for a policy of open competition between all disciplines in the natural sciences. Applications for financial assistance from STW can be made throughout the year by senior researchers at Dutch universities. All applications in technology are welcome. Every application is sent to six peers in the field; some are university staff and others work in industry. They are asked to give well-founded comments based on two criteria: scientific quality and utilization potential. From the comments received, the STW staff compiles a document in which their comments are anonymous. The principal investigator is allowed to reply to each comment; the actual words are typed in italics directly under each comment. The complete document is called a protocol. It provides the arguments in favour and against the proposal. When the protocols for 20 proposals (regardless of their individual topics) are ready, a jury is formed consisting of 12 highly qualified persons coming from universities, government laboratories and industry. Disciplines and other backgrounds vary widely. The names of the members are not divulged. The work is done free of charge and each member of the jury is only allowed to participate once; the next 20 proposals are handled by a new jury. The members of the jury are asked to give their judgement using two scales of whole numbers from 1 to 9. The average of the 12 ratings is then

calculated. Each proposal therefore receives two grades. Next, a priority list is drawn up using the average of the two scores for each proposal (thus giving equal weight to scientific quality and utilization potential). Finally, the STW board takes a decision in accordance with the priority list. In practice 40% of all proposals are funded.

The above is only the start of an interesting research project and the transfer of knowledge to the industry and society. STW will stay active in stimulating the knowledge transfer through the chosen instrument of user committees.

STW user committees

Directly after a project has been approved, STW and the research group invite users to join the user committee. The members of this committee are not restricted to potential users in industry; researchers from governmental institutes, hospitals, other universities and other interested groups in society are also welcome. Participation in the committee enables them to discuss the progress of the research, the options for utilization and knowledge protection policies. Members are not automatically entitled to use the results commercially. For this, an agreement with STW, the legal owner of the know-how generated, has to be negotiated. The members of the committee are the first to learn about the results through reports, meetings and personal contacts with the research team.

Members can often also contribute to the research. They can provide (confidential) data from earlier investigations within their own organization, assist with special measurement techniques that are not available at the university, or bring in their expertise. When a user committee is first set up the members are not all convinced that it will be a fruitful undertaking. But these doubts frequently disappear after the first meeting. Although the new knowledge is often not directly applicable, the new ideas and the new insights are worthwhile and used in the decision-making process within industry.

Utilization of results of STW academic research grants

From the beginning in 1981, STW incorporated contribution to society as the second main criterion, besides scientific quality. Also from the beginning, in addition to proposal assessment, much attention was devoted to the monitoring of ongoing research and past performance assessment of completed research. Projects were granted for four years and the first interim utilization report was produced in 1986. This report presented a summary of the results of the transfer of academic knowledge activities. The results were presented on a four-point scale ('no use at all', 'potential users are known' and 'actual use with or without an agreement between a company and STW on royalties'). These results show a shift over time from interest in 'potential users' while monitoring the research to 'actual users' of results many years after completion of the research. From 1992 on, final utilization reports (10 years after start of the project) were produced. These reports contain the assessment six years after completion of the academic research projects supported by STW. So far, the (10-year) final utilization results of nearly 400 projects have been presented to the public. During this period, the need has been felt both within STW and within government for a better model for assessing ultimate final utilization. I was involved in the development of the first STW model and studied the options for a better model. In 1993 a new model[3] was introduced by STW programme officer Mombers and director Le Pair. Trying to further improve that model, I studied hundreds of STW research projects intensively. Under my supervision, Van Caulil conducted his Masters research on the foundations of the evaluation practices (and a literature survey on evaluation practices) and analysed the second STW model in search of a better model. Mombers was also involved. The results were publicized in *Scientometrics* 1996 (Van Caulil *et al*, 1996). One of the conclusions was that there is currently no satisfactory method for measuring the utilization of scientific research.

I derived some new ideas from the hundreds of projects I studied, combined with my knowledge of the practices of research agencies around the world and my contacts with scientists on the matter. The first concepts were presented in Australia at a workshop organized by the Australian Research Council (ARC) in 1996 and published by the ARC in 1997. A random sample of 87 STW research projects was taken and analysed using the first STW four-category utilization model. It was discovered that there is a positive linear correlation between the jury utilization assessment of the proposals and the 10-year-later utilization score. A follow-up was published in the Journal of Technology Transfer in the summer of 1997. In this study, the second STW model (which is still in use) was used to compare 44 STW projects (a mix of fields) with a set of 23 STW projects in the Sensor Technology field (Van den Beemt, 1997). It was

3. Ten years after the start of the research (six years after the project had ended), STW updates the utilization report for all the projects involved. In 1993, STW set up a framework consisting of three aspects for determining the degree of utilization so that we would be able to view at a glance how many projects had achieved our goals. These aspects are as follows: 'the involvement of the user during the research,' 'the availability of a transferable product,' and 'the financial benefits for STW resulting from the research results'. Each project was given a score on a four-point scale for each of these three aspects: 0 (poor or low), A, B, and C (excellent or high). The aspects 'involvement of the user' and 'transferable product' give us more insight into what has been achieved and how successful the project has been, but these aspects cannot guarantee that the outcomes will be used by others. They cannot be used as indicators for utilization 'after'. Only the aspect 'financial benefits for STW resulting from the research' can be seen as a real indicator of utilization. By financial benefits we do not mean the financial support given by third parties (mainly industry) during the research, but the royalties paid by third parties to STW (or sometimes directly to the university) because they make use of the outcomes of research projects funded by STW. This money is usually paid to STW over a period of years after the research project has ended. This indicator, however, refers to only a part of the utilization aspect. There are many results, which are well used in industry, but do not bring in royalties to STW.

discovered that nearly 70% of STW projects did show an actual utilization six years after the research is completed. The utilization indicator refers to various degrees of utilization including widespread or local use, direct or indirect use, complete or partial use. This figure is very high but at the same time the definition is still very broad and the results are investigated six years after completion of the research. Directly after completion of the research, the utilization indicator was nearly 30%. Industrial users need a long time to make decisions on further investments, perform follow-up industrial R&D and realize an innovation on the market.

I believe that we need a new model which is independent from direct use on STW projects. The core of the model must be applicable to all kinds of academic research projects. It should provide an insight into the realized utilization and the underlying knowledge-transfer process from university to actual practice.

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Summary

We found six factors important to knowledge transfer while research is in progress:

1. Academics often act as the source of the new ideas in the early phase of an innovation.
2. 'Champions' can boost the early knowledge transfer process.
3. Commercial awareness is not restricted to industry.
4. Networks and one-to-one personal contacts are important for knowledge transfer.
5. Continuity of academic research acts as a backing for industry in its long R&D process.
6. Intellectual property and know-how come in many forms and are not restricted to patents.

The practices of the Dutch Technology Foundation STW were described and the utilization evaluation studies of STW academic research projects revealed quite good results. However, a good model for measurement of utilization after projects have been completed is still lacking.

Literature

- Atiyah, Sir Michael, 'Supporting the rigorous assessment of research', EPSRC Newsline, 1996
- European Physics Society, 'The future of the interaction between industry, universities and research institutes', Conference report by Peter Melville (Institute of Physics), January/February 1997
- Engineering Research Centres Programme, Annual Report, October 1997
- Garnsey, E., 'Science-based enterprise: threat or opportunity?', *Physics World Forum*, July 1997, pp. 15-17
- Hameri, A.P., 'Innovating from Big Science Research', *The Journal of Technology Transfer*, Vol. 22, no. 3, 1997, pp. 27-36
- Harabi, N., 'Appropriability of technical innovations: An empirical analysis', *Research Policy*, 24, 1995, pp. 981-992
- Hetzner, W.A., T.R. Gidley and D.O. Gray, 'Cooperative research and rising expectations: Lessons from the NSF's Industry/University Cooperative Research Centres', *Technology in Society*, Vol. 11, 1989, pp. 335-345
- Industrial Research Institute Research Corporation, 'Contribution of basic research to recent successful industrial innovations (54 cases of successful innovations in 29 companies)', NSF Grant No. PRA77-17908, final report, September 1979
- Industrial Research Institute Research Corporation, 'Summary of interviews with 17 senior industrial officials' in *The Government-University-Industry Research Roundtable in conjunction with the Industrial Research Institute: Industrial Perspectives on Innovation and Interactions with Universities*, National Academy Press, Washington D.C., February 1991
- Jacobs, M., 'Taking the measure of basic research', NSF-sponsored workshop of the Chemical Sciences Roundtable, C&EN, *Science Policy,* October 20 1997, pp. 30-33
- Kruytbosch, C.E., 'Some social and organizational characteristics of breakthrough science: An analysis of major innovations in four fields of science, 1950-1976', paper presented at the IX World Congress of Sociology, Uppsala, Sweden, August 17th, 1978
- Kommission zur Förderung der wissenschaftlichen Forschung, 'Evaluation der Förderung praxisorientierter Forschung', Bundesamt für Konjunkturfragen Studie Nr. 12, Lausanne und Bern, 1989
- Marcy, W. and B.M. Kosloski, Research Corporation Invention Administration Programme, 'Study of patents resulting from NSF Chemistry Programme', report for the NSF Evaluation Staff, Office of Audit and Oversight, NSF contract No. EVL-8107270, September 1982
- Nelsen, L., 'The rise of intellectual property protection in the American university', *Science*, Vol. 279, March 1998
- Parker, L.E., 'Results of outcome studies of the Engineering Research Centres Programme', copy of the sheets of the presentation to the annual meeting of the Society for the Social Study of Science, Tucson, October 1997
- Rogers, J.D. and B. Bozeman, 'Basic research and success of federal lab-industry partnerships' (Questionnaire-

based data of 229 joint federal laboratory-industry R&D projects with 219 companies and 27 laboratories), NSF Contract No. 9220125 1997, *The Journal of Technology Transfer,* Vol. 22, No. 3, Autumn 1997, pp. 37-47
- Rosenberg, N. and R. Nelson, 'American universities and technical advance in industry', *Research Policy* 23, 1994, pp. 323 - 348
- Rubenstein, A., E. Geisler and R. Abisenghe, 'Industrial practices of research conversion and technology transfer', *The Journal of Technology Transfer,* Vol. 22, No. 3, Autumn 1997, pp. 49-56
- Science Policy Research Unit, University of Sussex, 'The links between university physics and industry', final report of study commissioned by the Institute of Physics and carried out by Keith Sequeira and Ben Martin, submitted to the Institute of Physics, January 1997
- Van Caulil, G.F., C.A.M. Mombers and F.H.C.D. van den Beemt, 'Quantifying the utilization of research: the difficulties and two models to evaluate the utilization of research results', *Scientometrics*, Vol. 37, no. 3, 1996, pp. 433-444
- Van den Beemt, F.C.H.D. and A.F.J. van Raan (1995a), 'Evaluating research proposals', *Nature*, Vol. 375, 25 May 1995, p. 272
- Van den Beemt, F.C.H.D. and A.F.J. Van Raan (1995b), 'What do bibliometrics and peer review of research proposals have in common?', proceedings of the European Conference on Management of Technology, Aston University, Birmingham, 5-7 July 1995, pp. 685-691
- Van den Beemt, F.C.H.D., 'Evaluating prediction of technology transfer success: An interim evaluation of the Dutch Sensor Technology Programme', *The Journal of Technology Transfer,* Vol. 22, no. 2, Summer 1997, pp. 53-58

Utilization of technological research for resource-poor farmers: the need for an interactive innovation process[1]

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1. Paper prepared by Joske Bunders, Jacqueline Broerse, Marjolein Zweekhorst and Rebecca Teclemariam-Mesbah, based on the lecture given by Joske Bunders. Parts of this paper are adapted from Bunders *et al.*, 1999, Broerse and Bunders, 1999, Zweekhorst *et al,* 2000.

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3. According to Von Hippel (1988) user-dominated innovations are characterized by the fact that product users recognize the need for an innovation, solve the problem through intervention, build a prototype and prove the prototypes value in use. The locus of almost the entire process is centred on the user. In user-led innovation the user's criteria are the driving force in the development process but other (technical as well as non-technical) institutions are also actively involved in the process.

Introduction

Agricultural technologies have long been seen as a very potent answer to the problems of poverty in developing countries. Vast reservoirs of technological knowledge are present in research institutes around the world. But does this knowledge ever affect the life of resource-poor farmers, the ones who need it most? It has been shown that many innovations never reach the poor and utilization of knowledge by them is extremely problematic. Numerous analyses have shown that the innovations suggested to them were not what they were looking for. How then, can one develop innovations that can be utilized by the poor? Experience shows that 'just asking the resource-poor farmers what they need' is not as simple as it seems. All actors involved in the development and dissemination of innovations want to and should have a say. Power relations/hierarchies are usually not in favour of resource-poor farmers.

In this paper we investigate possible strategies for integrating the knowledge of various actors involved during the design and implementation phase of development projects aimed at resource-poor farmers. After describing the different models of technological innovation, we present a case study in Bangladesh. A brief overview is given of the agricultural innovation system in Bangladesh as well as the methodology, results and difficulties of the project *'Interactive and Participatory Strategies for Generating Innovations for Resource-Poor Farmers'* (IPSI) in Bangladesh in which we are currently involved[2]. We conclude with some policy suggestions for donor organizations.

1. Technological innovation models

1.1. Linear model

The linear model is currently the dominant mode of technology transfer throughout the world. Highly specialized and trained specialists develop innovations in research centres. After successful field trials at the centres, the innovations are transferred to the farmers via extension services. There is no feedback from the farmers to the research institutes. This linear model is also called the Transfer of Technologies (TOT) methodology (Chambers and Ghildyal, 1985; Scoones and Thompson, 1993). In general, the TOT methodology has been very successful in industry and in agriculture with resource-rich clients. Chambers and Ghildyal (1985) suggest three main reasons for this. Firstly, the model is effective in achieving increases in food production. Secondly, it can been used internationally. As long as the environmental conditions are the same, the technologies can be transferred all over the world. Thirdly, there are many rewards for scientists, both at national and international level, including publication in international journals which focus on expensive, sophisticated research on cutting edge technologies.

The TOT model has however been widely criticized (Chambers and Ghildyal, 1985; Scoones, and Thompson, 1993; Broerse, 1998; van Veldhuizen *et al.*, 1997). Although the model has been successful in industry and agriculture with resource-rich clients, it is not considered appropriate for resource-poor clients, including farmers, who hardly adopt innovations developed through this approach. Evaluation studies have shown that this is not because of a lack of knowledge but because the innovations do not fit farmers' needs and their specific physical, social and economic conditions. It was clear that small-scale, resource-poor farmers' knowledge and the broader context of their situation should be taken into account.

1.2. Triple helix model

One of the successors to the linear model is the Triple Helix model. In this model the development of innovations is seen as a spiral process which emerges from reflexive university-industry-government interactions (Leydersdorff and Etzkowitz 1996). Analysis of these interactions was lacking in the linear model. The new model not only focuses on the interactions between the different actors in the innovation process, it also indicates which actors (industry, university and government) are the most important. The triple helix model is descriptive and analytical, as well as prescriptive; in order to stimulate technological innovation in a country one should stimulate efficient triple helix interactions. This suggestion underscores the fact that although these interactions are usually necessary conditions for technological innovation, they are often not a sufficient condition.

1.3. Participatory models

During the past two decades, several strategies have been developed to stimulate the generation of user-dominated or user-led innovations[3].

At the beginning of the 1980s it became clear that, for technology development directed towards small-scale, resource-poor farmers, it is important that explicit attention be paid during the design phase of a project to the socio-cultural, political

and institutional context in which farmers operate (Cernea, 1991; Dusseldorp and Box, 1990). This shifted the focus from research stations and laboratories to the farmers themselves. Initially it was assumed that social scientists would be able to collect the knowledge of farmers in a short time and then develop technological innovations at the research stations. Evaluation studies of these so-called 'Farmers First' approaches[4] revealed that it is not sufficient to consult farmers only during the design phase of a project. Instead, they must be active participants throughout the project by continuously providing checks and balances on the collected information, priorities, ideas for possible solutions, the proposed sequence of action, project evaluation and so on (Cornwall *et al.*, 1993; Scoones and Thompson, 1993). This insight led to the emergence of new approaches called 'Beyond Farmers First'[5]. These involve the farmers actively during the whole process of technology development, resulting in a user-dominated innovation process. Farming is seen as a highly complex and dynamic process within a broader social context, while knowledge is seen as complex, value-bound, context-determined, multi-layered and fragmentary, with complex interactions. Power relations, conflict and negotiation are important to identify constraints and to find solutions. Most of the 'Beyond Farmers First' approaches use Participatory Rural Appraisal (PRA) techniques[6] to enable local people to share, enhance and analyse their knowledge of life and conditions, and to plan, act, monitor and evaluate (Chambers, 1997). Development of local capacities and socio-cultural structures are considered necessary to sustain the change process (Bunders *et al.*, 1996; Haverkort *et al.*, 1991; Reijntjes *et al.*, 1992).

Specific strategies focused on enhancing the generation of science-based innovations have also been developed. Several of these strategies enhance a user-led innovation process, in which the users' criteria are the driving force in the development process, but other institutions are also actively involved. Examples are Constructive Technology Assessment (CTA) and Interactive Technology Assessment (ITA). In these strategies more actors are involved in the early phases of the technological innovation process. Dialogue between, and early interaction with, a wide variety of actors, including the users, is facilitated. The overall objective of both strategies is to broaden the decision-making process on the design of new technologies (and the redesign of old technologies) in order to meet societal goals (Schot and Rip, 1997; Williams and Edge, 1996). The disadvantage of CTA and ITA is that feedback to the technology developers is not embedded within the strategies; it is expected that innovators spontaneously pick up the ideas. However, this rarely happens (Schot and Rip, 1997).

Evaluations so far show that the innovations resulting from participatory approaches are quite successful in improving the livelihood of the poor (e.g. Chambers, 1997; Reijntjes *et al.*, 1992; van Veldhuizen *et al.*, 1997). Unfortunately, they often remain isolated and local activities, benefiting only relatively small numbers of people and largely ignoring new scientific developments.

1.4. Interactive Learning and Action

Initially developed by the Department of Biology and Society of the Vrije Universiteit Amsterdam to guide the development of biotechnological innovations for small-scale agriculture, the Interactive Learning and Action (ILA) approach addresses the shortcomings of the above-mentioned user-dominated and user-led innovation strategies (Broerse, 1998; Bunders *et al.*, 1996). The ILA approach facilitates a user-led, science-based innovation process by actively involving the user throughout the innovation process. The approach has been developed from the premise that, on the one hand, it is possible to influence the direction of technology development, and that, on the other hand, technology can contribute meaningfully to poverty alleviation and sustainable development. It offers a mode for operating a research process in such a way that appropriate technologies within formal scientific institutions can be generated. The ILA approach is based on several principles: (1) resource-poor farmers have a prominent role in decision making, (2) the innovation process is centred around a vision, (3) the development of trust relationships is facilitated, (4) mutual learning between participants is facilitated, (5) coalition building is enhanced, (6) different types of knowledge are integrated, and (7) intermediaries (an interdisciplinary team) guide the process.

In the ILA approach, *resource-poor farmers need to have a prominent role* in decision- making throughout the innovation process. It is not sufficient to 'consult' farmers only during the phase of data collection. This easily leads to misinterpretation. Active participation of farmers during the entire innovation process is probably

4. For example, Rapid Rural Appraisal (RRA), Farmers First and Last (FFL), Farming Systems Research (FSR) or Agro-Ecosystem Analysis (AEA) (Conway, 1985)

5. For example, Farmer Participatory Research (FPR), Participatory Technology Development (PTD) (e.g. Haverkort *et al*, 1991; Reijntjes *et al*, 1992), and Participatory Learning and Action (PLA) (e.g. Pretty, 1995). Each of these has its own emphasis and field of application.

6. PRA techniques provide alternatives for questionnaires and typically involve maps and diagrams, and have proven to be quite successful in analysing the livelihoods of the poor (Blackburn and Holland, 1998; Chambers, 1997).

one of the best guarantees for the actual generation of appropriate technologies.

The entire innovation process needs to be centred on the *'vision'* that science-based innovations can contribute to poverty alleviation. The ILA approach is not only procedural but also very much outcome-oriented. This commitment to a vision provides a sense of direction -which actions are considered most suitable at what time by the participants in reaching the objective of generating appropriate biotechnology for small-scale farmers. The interdisciplinary team, which guides the ILA process, will identify people who share the vision. On the basis of commitment to the vision, participants in the process derive their willingness to collaborate, to overcome difficulties and uncertainties and to take risks. Thus the commitment to the shared vision provides the oil which lubricates the engine of change.

In the ILA process the development of '*trust relationships'* needs to be facilitated. In the interaction between members of the interdisciplinary team and participating actors, and between participating actors themselves, a certain level of 'trust' is crucial for (a) obtaining insight into sensitive information and tacit knowledge[7], which is necessary for identifying and using the room for manoeuvre, and (b) enhancing mutual learning between, and risk-taking behaviour by, different actors involved in the process. At the beginning of the ILA process the level of trust is generally low. There are usually no routines, procedures and protocols on which the activities can be based - an innovative process for and with small-scale farmers is rarely present. Accomplishing innovation and change - the aim of the interdisciplinary team - invariably threatens the status quo and thus causes uncertainty, anxiety and defensive behaviour in many actors (Pfeffer, 1992). In addition, many actors are likely to have no history of interaction and are very diverse in terms of cultural background and interests. The methodology of the ILA approach, therefore, incorporates several mechanisms to create conditions which are conducive to the development of trust relationships.

For communication and interaction to be effective - besides the facilitation of trust relationships - the facilitation of '*mutual learning'* between the participants is important. A condition for successful cooperation is respect and the willingness to listen. Each person involved in the process needs to recognize the others' expertise and potential contribution to the concerted effort, and behave accordingly. Reflexivity is a key element in this respect. Moreover, in the process of mutual learning feedback and feed-forward mechanisms are created to allow two important and interrelated requirements for developing appropriate technology to be met: firstly, the exchange of information, and secondly the reconstruction and verification of participants' opinions. Opinions on research priorities are likely to differ not only between but also within the different professional communities (for example between male and female farmers or between social scientists and biologists). Moreover, because of the differences in social, cultural, educational and professional background between the different actors, prejudice and misinterpretation of ideas and objectives may easily occur. Particularly the feed-forward mechanism can result in increased respect, reflexivity and willingness to listen among actors, thereby inducing a 'learning attitude'. If participants are not willing or able to have such a learning attitude their role in the process is likely to be marginal.

Also crucial for the success of the innovation process is '*coalition building'*. A 'coalition' of people from different areas serves as a check-and-balance. Coalition building ensures that sufficient and appropriate support (endorsement, backing, approval, legitimacy) and resources (e.g. knowledge, funds, materials, time) will be available to maintain the momentum of a project and guarantee its implementation. An important part of coalition building is establishing a 'support group' of peers and actors from higher levels (for example managers, politicians, government officials and village chiefs) who can provide advice and criticism. The members of this support group share a strong commitment to the vision. Discussions between the interdisciplinary team and the support group, because of the trust that is developed, focus on opportunities and constraints in depth. Important is that tacit knowledge is made explicit and the room for manoeuvre becomes clear.

The ILA approach is also characterized by a high degree of *knowledge integration.* Information is collected in the following knowledge domains (e.g. Wilber, 1995 and 1998):

- *Physical/technological domain:* this concerns knowledge about the visible reality, which in this case refers to the actual agricultural situation. Accessing knowledge in this domain typically

7. Tacit knowledge is highly personal and hard to formalize, making it difficult to communicate or to share with others. It is deeply rooted in an indvidual's action, experience, ideals and values. It can be segmented into two dimensions: the technical dimension, which encompasses the kind of informal and hard-to-pin-down skills or crafts captured in the term 'know-how', and a cognitive dimension which consists of schemata, mental models, beliefs and perceptions so ingrained that we take them for granted (Nonaka and Takeuchi, 1995; p. 8).

involves inventory studies on, for example, farming systems and current agricultural research and innovations.
- *Institutional domain:* this domain covers issues relating to the formal structures that determine human societies, such as living conditions, the techno-economic situation, physical infrastructure, type and structure of organizations, rules and regulations.
- *Cultural/shared values domain:* this domain refers to knowledge about worldviews, common interpretative understandings, norms of behaviour, self-imposed codes of conduct, cultural meanings, images of nature, and moral and ethical understanding of communities.
- *Personal/intentional domain:* this domain focuses on knowledge about the people (their ideas, beliefs, interests, hopes and fears) in local communities as individuals instead of collectivities.

This implies that knowledge regarding more objective phenomena (physical and institutional domains) needs to be integrated with knowledge relating to more subjective notions. While the positivist paradigm[8] is usually more appropriate for studying objective phenomena, a constructivist or hermeneutic paradigm[9] is preferable when subjective notions are being considered. Integrating data, collected in the different knowledge domains, thus involves the integration of these two main research frameworks or paradigms.

'Intermediaries' guide the process of communication, cooperation, learning and coalition building between the various actors. They (1) have a mediating and facilitating role between the various actors, anticipating problems that result from differences in views, language and power, (2) collect, exchange, link and integrate information and knowledge, and (3) act as change agents. To be able to perform these tasks successfully, a team approach is preferred over one person performing all tasks. Information from many different sources and disciplines needs to be collected and integrated, and bottlenecks have to be overcome. Thus, an interdisciplinary team is to be established.

To facilitate the application of an ILA approach, the activities are structured in four phases:
- *Phase 1: Initiation and preparation:* the objectives of this phase are to establish and train an interdisciplinary team of intermediaries to become familiar with the socioeconomic, ecological and political setting and the local community, and to choose an area for on-farm research.
- *Phase 2: Collection, exchange and integration of information:* in this phase the research needs of farmers are identified. The phase begins with an appraisal of the main characteristics of the agricultural system, from the perspective of each of the actors involved. Next, the status of currently available agricultural innovations is assessed. In undertaking this activity, the team can generate awareness of the ILA process on the part of relevant individuals and institutions, enlisting their support for later activities. This phase allows all involved to obtain a basic understanding of the relevant issues and of the points of view of the various participants. The team collects data, organizes recurrent dialogues with key informants, and analyses and integrates information and knowledge.
- *Phase 3: Public priority setting and planning:* although farmers or others may decide they wish to test relevant options at any stage of the process, it is advisable at some time to organize and hold a priority setting and planning workshop that brings together all actors involved. The objectives of such a workshop are: (1) to allow review and criticism of the team's findings by a wide audience, (2) to legitimize the findings, (3) to allow room for new contributions, (4) to enhance the visibility of the needs of small-scale farmers, and (5) to establish a plan of action. Discussions at the workshop should lead to consensus on the most important topics for research at farm and laboratory level, and on any other relevant matters (links between research at different levels, changes in policy, etc.). After the workshop, the results of the information analysis and integration exercise can be published, together with (or separately from) the workshop proceedings. The mechanisms used to give feedback should be adapted to the different actors addressed.
- *Phase 4: Project formulation and implementation:* the plan of action drawn up during the previous phase forms the input to the fourth phase, in which specific projects are formulated and implemented. These projects are, or should be, a direct response to the needs expressed by farmers. Activities could include:
  - experiments at farm level
  - institution-based R&D
  - changes to the policy environment
  - training in the ILA approach at institutional level
  - improvements to the approach followed

8. Since the seventeenth century scientific inquiry has been dominated by the positivist paradigm. This approach posits that there exists an objective single reality which operates according to immutable natural laws (Guba and Lincoln, 1989). Science seeks to discover the true nature of this reality. Objectivist epistemology asserts that it is possible (and mandatory) for an observer to exteriorize the phenomenon studied, remaining detached and distant from it (subject-object dualism), and excluding any value considerations from influencing it. An interventionist methodology strips context of its contaminating influences (variables) in order to understand nature as it really is and really works. The ultimate aim is to discover, predict and control natural phenomena.

9. Over the past 30 years, the positivist view has been criticized, particularly when larger complex systems are studied (which are only relevant within their context) and when human values and subjective perceptions come into question; in those cases positivist premises fall short. One of the main principles of the new paradigms is that 'reality' is open to interpretation; knowledge and understanding are socially constructed. 'Truth' is defined as the best informed and most sophisticated construction on which there is consensus (although there may be several constructions extant that may simultaneously meet that criterion). Subjectivist epistemology asserts that an inquirer and the inquired into are interlocked in such a way that the findings of an investigation are the literal creation of the inquiry process. A hermeneutic methodology involves a continuing dialectic of iteration, analysis, critique, reiteration, reanalysis and so on, leading to the emergence of a joint construction of a case (Guba and Lincoln, 1989).

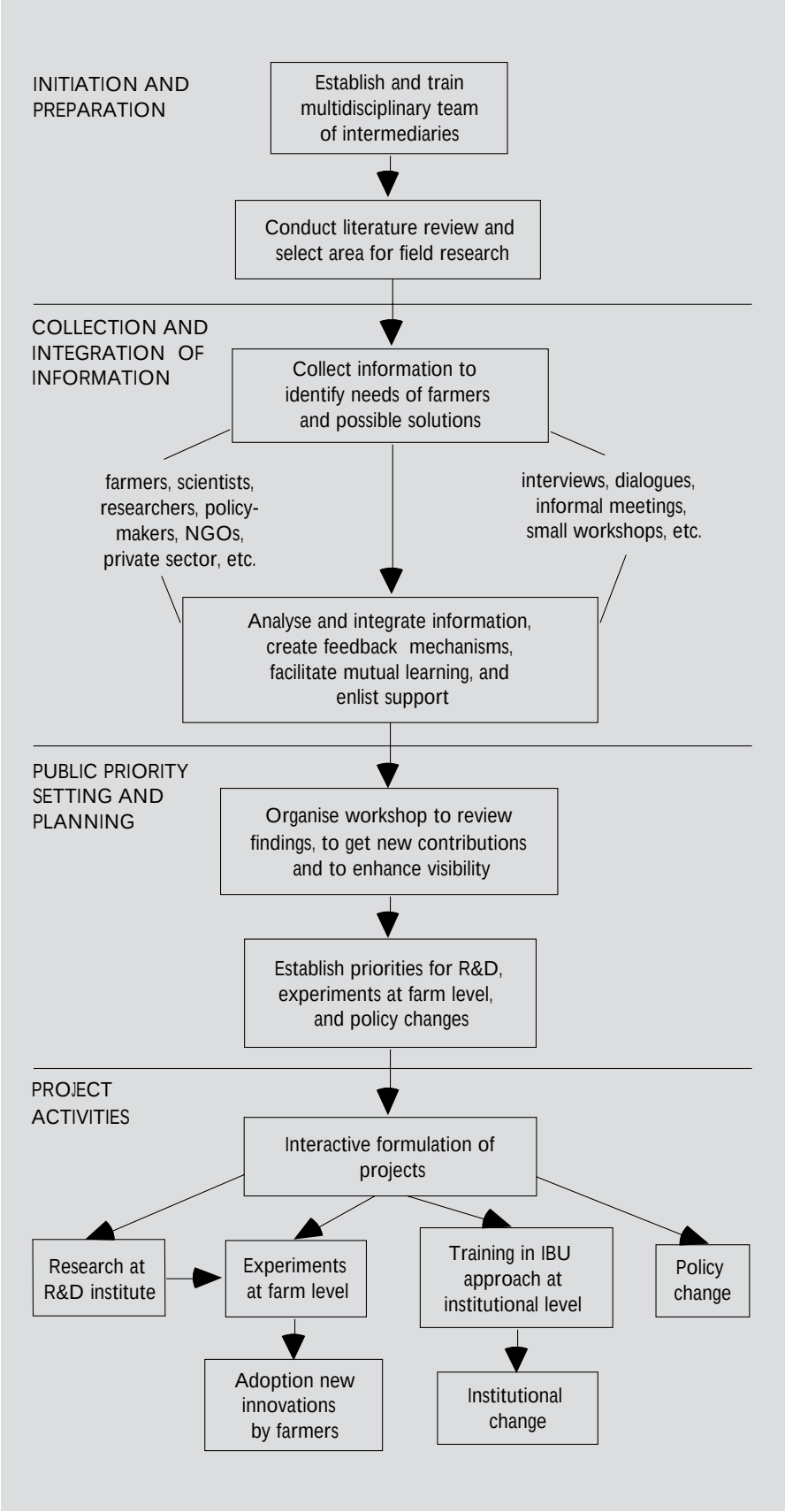

Figure 1: the four phases of the ILA approach (source Broerse, 1998 page 215)

Project formulation and implementation can be undertaken at any level and may focus either directly on the farming community, on research institutions or policy-making bodies, or any combination of these. As in the previous phases, it is essential that formulation and implementation should be interactive, exploring the options in close collaboration with all concerned.

These four phases can be broadly distinguished on the basis of their chronology, the outcome of the previous phase being the input for the next. Yet the phases overlap, as each consists of activities which may be undertaken several times in a different order throughout the process. In this way an interactive, iterative, spiral (rather than linear) process evolves. The first three phases are likely to take at least three months, while the entire process will probably last several years. Figure 1 shows the different phases and activities of the ILA approach.

Based on fieldwork in Zimbabwe and Ghana, Broerse (1998) describes the ILA approach (then called the Interactive Bottom Up approach) as: 'a sophisticated strategy for enhancing a farmer oriented (bio) technological innovation process in developing countries.' (p. 214). One of her conclusions is that application of the ILA approach enables a prioritized research agenda to be established. Although the ILA was at the time a rather isolated activity, it was clear that upscaling and consolidation of the activities over longer periods of time were considered particularly crucial.

2. The agricultural innovation system in Bangladesh

Bangladesh is one of the poorest countries in the world; nearly half of the total population lives below the UN-defined poverty line (UNDP 1997). It is one of the world's most densely populated countries. Although 95% of the cultivable land is under crops, agricultural production is too low to feed its population. Agriculture accounts for about one-third of the country's gross domestic production and employs around two-thirds of the total labour force (UNDP 1997). Approximately one-fourth of rural households has no land or only a homestead (less than 0.05 acres), and approximately three-quarters of farm holdings are less than 2.5 acres. The majority of the farmers can be characterized as resource-poor, usually not producing sufficient to survive and needing supplementary income. Crop-livestock mixed

farming predominates, with rice as the major crop (Hossain 1991).

The main objective of government agricultural policies has been to achieve food self-sufficiency and food security (Clay *et al.* 1989; Islam 1989). Many programmes have been implemented over the past three decades to increase the production of food grains. A 'Green Revolution' strategy has been pursued based on the introduction of high-yielding varieties of rice and wheat, irrigation, chemical fertilizers and pesticides (Clay *et al.* 1989; Ullah 1996). These innovations and accompanying infrastructural measures initially increased production considerably. However, there has been a slowdown in the rate of increase of cereal production. Bangladesh is, therefore, still relying on imports of food grains to sustain its rapidly growing population at minimum caloric levels (UNDP 1997). In recent years, more emphasis has been placed on agricultural innovation and diversification - the increased production of non-cereal crops, fish and livestock.

Although the Bangladeshi agricultural research system[10] has grown rapidly since 1975, from many different perspectives it can be concluded that the system is rather marginal[11] and faces numerous constraints (Jabbar and Abedin, 1989). Funds for research activities are inadequate: government investment in this sector is low - as well as irregular - due to heavy dependence on project-linked donor funding. As a consequence, research in Bangladesh often reflects the research priorities of the donor agencies. Due to monocrop-oriented research institutes, research capacities have become thinly distributed. The number of well-qualified researchers and publications in international journals is low. In addition, the various components and disciplines of the system have not received equal attention. Emphasis is placed on crop genetic research, while agronomic and socioeconomic research, and livestock, fisheries and forestry have received less priority. Much research is highly adaptive in nature and has often limited social relevance. No attempts are made for horizontal integration (linking different scientific disciplines), while vertical integration (linking research and application) is equally weak. The question of specific user groups, for example large or small-scale farmers, has not been explicitly considered by researchers, but in practice larger farmers have benefited more from research results because of their better resource base and access to improved technology and inputs.

Innovations developed through the Bangladesh agricultural research system are - once proven effective at research stations - transferred to other governmental agencies, which disseminate them further. However, the extension service suffers from inadequate and ill-trained agents and low operational budgets, while other agencies[12] are often criticized for the poor efficiency and low productivity of their services. Moreover, these services are oriented towards the more privileged sector of the farming community and usually do not reach resource-poor farmers (Hossain 1991).

Technology transfer from universities or research institutes to the private sector hardly occurs in Bangladesh. Few firms have ever had contact with public-sector researchers or have used knowledge or innovations developed by the Bangladeshi research system. In-house R&D capacity is virtually non-existent in the private sector. During the 1970s, many enterprises came under state ownership, only to be largely privatized again some five years later (Alam, 1995). The relationship between the private sector and the state has improved considerably, but has nowadays turned into an instrument of patronage[13]. Conditions in Bangladesh are not particularly conducive to productive investment and innovation. Entrepreneurs are more biased towards trading and commercial activities where the return on invested capital is quick and less risky, and the rate of profit is relatively high. This is largely due to the aid-dependent, primary-export-led character of the economy and the weakness of the entrepreneurial class, combined with the unstable political situation, infrastructural problems, inappropriate incentive policies and a relatively poor market (Abdullah and Rahman, 1989; Alam, 1995). Profits are often transferred abroad instead of being reinvested in the country. Technologies and other inputs are usually imported.

In general, it can be concluded that (a) the Bangladeshi agricultural research system is rather marginal, (b) linkages for innovation between universities, government and industry are weak, (c) the innovative capacity of industry is poor and (d) the country relies heavily on the import of science and technology from abroad. Strategies for improving research in Bangladesh include increasing the infrastructures available, training of staff at all levels, developing North-South cooperation and enhancing the role of non-governmental organizations (NGOs).

10. The Bangladesh Agricultural Research Council (BARC), under which all agricultural research institutes reside, is responsible for planning and coordination of research at national level. By far the largest institute in the country is the Bangladesh Agricultural Research Institute (BARI). It handles all crops other than those covered under monocrop institutes (rice, jute, sugarcane and tea).

11. There are a few exceptions to this, like the Bangladesh Institute for Development Studies, which can compete with its Western sister organizations, like the Institute for Development Studies in Sussex (UK) or the Institute of Social Studies in The Hague (the Netherlands).

12. Governmental agencies such as the Bangladesh Agricultural Development Corporation (BADC) and the Bangladesh Water Development Board (BDWB).

13. Alam (1995: 158) describes the situation of the past decade as follows: 'The weak industrial bourgeoisie supported the policy and the regime in order to strengthen their economic position with the political power.'

3. Interactive and Participatory Strategies for Generating Innovations for Resource-Poor Farmers (IPSI) in Bangladesh

The IPSI project is a joint effort of the Grameen Krishi Foundation, Bangladesh, and the Vrije Universiteit Amsterdam, the Netherlands. Its long-term objective is to contribute to the sustainable development of agricultural production of resource-poor, small-scale farmers in Bangladesh through a process of change in which formal technology research and development is adapted to be more effective and relevant to the needs of these farmers. A participatory and interactive methodology - the Interactive Learning and Action (ILA) approach - is used to identify needs, problems and options for technology research as well as to formulate and implement projects for resource-poor farmers.

3.1. The Grameen Krishi Foundation

The Grameen Krishi Foundation (GKF) was established in 1991 by the Grameen Bank, a community bank that provides loans and credit to the poor in Bangladesh. The bank became involved in Deep Tubewells (DTWs) on a significant scale in 1987 when it acquired over 2,500 in Tangail and in the greater Rangpur and Dinajpur region from the Government of Bangladesh. At first, the wells were managed under the Grameen Agricultural Project (GAP) but, because of the significant differences between managing a bank and an irrigation project, a separate organization was founded, the Grameen Krishi Foundation. GKF was set up as an autonomous non-governmental organization to be run on a self-sustaining basis and aiming at poverty alleviation, self-sufficiency in food production, and effective utilization of agricultural resources in seven regions in the northwest of Bangladesh. In 1998, GKF had 1,200 staff members, served a total number of 250,000 farmers in an area of 125,050 acres, and made its first profit of US$ 113,750 (Shah Alam, 1998).

GKF has set up an elaborate organizational structure, which is very bureaucratic with a charismatic leader. The management consists of a board of directors and the executive authority. The board of directors decides on overall policy and programmes, and the managing director, as chief executive, guides the planning and overall implementation of the programmes through the divisions located at head office and the different field offices. The divisions at head office control the targets of the field offices, supply the inputs, and run special programmes in the regions. The field offices are located in several regions, which work independently of each other and are subdivided into ‘units’ and ‘farms’. The farms and units form the operational base of the organization: they are directly responsible for implementation of the GKF programmes. GKF defines a farm as the area (approximately 50 hectares) serviced by a DTW. GKF operates the farms on partnership basis with the participating farmers. In general GKF is responsible for providing irrigation water (and later also other inputs), and the farmers are responsible for running the farms. In return, the harvested crops are shared as a fixed quantity or a certain percentage of the produce. Each unit manager supervises eight to fifteen farm managers, and each regional manager supervises four to thirteen unit managers.

After only two years, the GKF management realized that the organization could never become self-sustainable in the way it was operating at that time. The board of directors decided to close down several highly unprofitable ‘farms’. In addition, GKF established various programmes to diversify its products and services. The programmes currently run by GKF are briefly described below.

Programmes for the (near) landless

GKF has set up different activities for this group. Firstly, there is an employment programme which employs landless poor as guards and land labourers at GKF agricultural production and processing facilities (nurseries, crop and livestock farms and factories). Secondly, there are income-generating programmes, under which the landless obtain agricultural produce from GKF (on credit) and sell it on the local market, or agricultural equipment at a rental rate which they can use to work for third parties. Finally, GKF has established a so-called mortgage programme. During 1988-89, as a result of a series of natural disasters, many resource-poor farmers became functionally landless because they had to lease out their land. Within the framework of this programme GKF pays the entire amount for which the land has been mortgaged and in return the farm family cultivates the land in a sharing system. Usually, after three years, the family resumes full ownership of the land.

Credit programme

In March 1996, GKF launched a credit programme specifically targeted at resource-poor farmers owning 0.5 to 3 acres of land, for a wide variety of agricultural activities. At that time this group of farmers, which makes up about 40% of the families

in Bangladesh, was not eligible for credit from other NGOs in Bangladesh (Shah Alam, 1998). The programme is based on the Grameen Bank's well established system of providing loans to small groups of five men or women of the same social status, who take a collective responsibility for repayment.

General input supply programmes

It was observed that many farmers faced difficulties in obtaining agricultural inputs, such as seeds, fertilizer, pesticides and technical advice. Therefore, GKF decided to purchase inputs from suppliers and 'sell' these to farmers in the same way as irrigation water (share system). However, GKF staff encountered problems in obtaining sufficient amounts of good quality planting material themselves. In response, GKF started its own seed production programme, initially only producing seeds for cereal crops, and later also including vegetable seeds. Within this programme GKF uses two systems. Firstly it leases or purchases land on which wage labourers (landless) cultivate a crop for seed production. Secondly, farmers are contracted to cultivate a certain crop for seed production on their own land, and GKF pledges to buy the seeds at a fixed price. In addition, GKF recently started its own tissue-culture laboratory, which is initially only producing banana plantlets. In addition, GKF provides technical advice to farmers. It has set up demonstration farms to make farmers aware of new crops and new cultivation practices.

Programme for processing and marketing agricultural produce (and other goods)

This programme also consists of various activities. The produce GKF obtains through its share system has to be marketed. Only so-called non-perishable crops can be used as repayment in the share system. Most of this produce is sold directly to wholesalers, but some is processed by GKF - wheat in its own biscuit and bread factory, and cotton in its own weaving mill - before being marketed through GKF's supermarkets and drapery shops. GKF is currently in the process of establishing a processing plant to produce jellies.

Evaluation studies have shown that GKF, particularly in its general input supply programme, is predominantly servicing medium-scale farmers (owning about 5 acres of land). There are two main reasons for this. Firstly, due to the pressure to generate sufficient revenue to become self-reliant (for the first seven years it operated at a loss), GKF initially focused on the more profitable and easier to serve clients. Since medium-scale farmers require less operating costs (buying larger quantities and more inputs) and produce higher yields (implying higher income for GKF through the share system), they are more profitable for GKF than resource-poor farmers. In addition, various studies have shown that servicing resource-poor farmers is also costly because of the time-consuming process of identifying the client group[14] and assessing their needs and opportunities (e.g. Chambers, 1997; Pretty, 1998). Secondly, as mentioned before, most of the innovations developed by the agricultural research system in Bangladesh (and elsewhere) are not well adapted to the production conditions of most resource-poor farmers. Therefore, resource-poor farmers were often not interested in the products and services GKF was providing.

In 1996, the GKF management decided to focus their input supply programme also on resource-poor farmers, and to face the challenge of identifying, experimenting with and introducing innovations specifically for this group. Subsequently, in collaboration with the VUA, GKF has established an R&D department - the Technology Assessment (TA) Unit - in order to identify, select and test suitable innovations for resource-poor farmers.

3.2. A new unit

The TA unit has 10 members (Farm and Unit Managers). They received intensive training from VUA trainers in all steps of the ILA approach. The main task of the unit is to assist with the development and dissemination of innovations for resource-poor farmers. To this end, unit members:

- identify resource-poor farmers and assess their constraints and opportunities, applying techniques used in Participatory Learning and Action (PLA)[15];
- identify and assess innovations existing in and outside Bangladesh by collecting information through literature reviews, Internet searches and discussions with scientists;
- organize workshops to integrate all the data collected and draw up a research agenda (participants include farmers, scientists and other relevant actors);
- experiment with innovations on the unit's own plot and assist farmers in conducting experiments with innovations on their land;

14. Resource-poor farmers cannot merely be defined as farmers owning little land, since soil quality and access to irrigation facilities is equally important. In addition the size of the income generated through other activities (such as employment or business activities of the farmer or other family members) and value of family assets also determine whether a farmer is considered resource poor or not.

15. PLA was previously also called Participatory Rural Appraisal.

- monitor and evaluate the experiments, and write reports in which they discuss the results (most reports are distributed to relevant research institutes in Bangladesh).

If an innovation is considered appropriate a protocol is designed for disseminating it to resource-poor farmers through GKF's general programmes. In addition, further research may be specified.

A group of well-trained staff is now able to work independently and brainstorm, and has established a network through numerous external contacts. Several Memoranda of Understanding have been signed between GKF and Bangladeshi research institutes. As from 1997 numerous experiments have been performed with identified innovations by the TA unit and by resource-poor farmers. These include testing of (a) new varieties of various cereal crops, vegetables, oilseeds and pulses, (b) innovative planting materials, such as True Potato Seed, tissue-cultured banana, sugarcane, sweet potato and flowers, (c) new crops (for the region) such as soybean, summer tomato, cardamom and different types of flowers (orchids, gladiolus, chrysanthemum, carnation and birds of paradise), (d) new cultivation practices for various crops mentioned above (land preparation, seeding (methods and timing), intercultural operations and harvesting), and (e) new fencing and storage methods. Of the many experiments that have been conducted, several have produced very interesting and promising results. Numerous resource-poor farmers who participated in experiments with the TA unit are now enthusiastic about trying new innovations.

Some difficulties were faced in the establishment and operation of the TA unit. A major problem was to create a flexible and open learning environment within a more bureaucratic institutional setting. The staff training turned out to be quite time-consuming, since the required skills clearly contradicted with the normal standardized procedures set up and trained within GKF. Secondly, the attitudes of the trainees proved to be constraining for the application of participatory and interactive methodologies[16]. Thirdly, adverse climatic conditions (hailstorms, hurricanes, floods) and chronic political instability (frequent strikes which prevent mobility) made it difficult to plan and conduct agricultural experiments. Fourthly, the marginality of the research system in Bangladesh and the absence of local resources mean that external assistance often has to be sought, for example from India, the Philippines, Taiwan or Nepal. Another problem, which came to the fore more recently, is the relatively high turnover rate of TA unit staff. The trained unit members have acquired skills and attitudes that proved to be highly valuable to other organizations as well. Offering higher salaries international development organizations (such as CARE International) have been able to attract several unit staff members. In response, the salaries of the TA unit members have been slightly increased, but can still not compete with those offered in these organizations.

Last but not least, the TA unit still has to prove itself as being sustainable and profitable for GKF. At the moment, many of the unit's costs are borne by the donor organization. Participating resource-poor farmers receive inputs below cost prize. Moreover no innovations have currently reached the phase of dissemination through GKF's general input supply programme, and thus the activities of the TA unit have not yet generated income for GKF.

4. Concluding remarks

Utilization of research results by resource-poor farmers is generally looked at as a very complex issue. Lack of involvement of the end-user in the research design and execution seems to be a significant impediment to effective utilization. However, including the end-user throughout the process of technology development is not easy and straightforward. We have suggested that even in a systematic and long-term participatory approach (such as the ILA approach) many difficulties may occur. Due to the local specificities no general answers to these problems are at hand. Nevertheless our research suggests that through action research and experimentation many of these problems can be dealt with. In terms of utilization of the innovations developed through this process we might expect a positive outcome for the local context.

The question remains how to generalize the results. Most likely the innovations are not very suitable for resource-poor farmers in other regions. We would like to suggest that although the development processes in which the end-user is included are not the same in different contexts, we are likely to learn from comparing these processes. It would allow a practice to be developed which guides the local development process in an effective way.

16. The status difference between educated Bangladeshi and illiterate small-scale farmers constrains a direct, open and interactive dialogue between the TA unit and its clients.

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Donor organizations are encouraged to stimulate these types of approaches, as well as research which aims at understanding similarities and differences. Such research could contribute to the local development of innovations which will be applied by end-users who rarely benefit from general science and technology programmes.

Discussion

After the lecture, Mr Joan Boer, Deputy Director-General for International Cooperation, acted as discussant. He expressed his sympathy for the project, but wondered whether upscaling of such an approach would be possible. What are the possibilities for repeating the project on a large scale in Bangladesh? At what level of achievement does the project aim: small-scale success or large scale impact? A member of the audience asked whether the projects would lead to dependency, considering the marginality of the research infrastructure in Bangladesh. It was pointed out that conditions for sustainability and upscaling would be the level of literacy, good governance (e.g. decentralization/local planning), a non-hierarchical organization, and the level of organization of the knowledge system. DGIS experiences, like the Kerala research programme, have provided valuable insights in this respect. The issue of gender relations was also felt to be problematic in Bangladesh. Not all participants were positive about the partner organization. It was doubted whether a participatory approach could work in an organization affiliated to the Grameen Bank, which is non-participatory. It was suggested that a better partner could have been found among the agricultural research institutions, many of which have received support from DGIS. Ms Bunders responded that these institutions are involved, and that the projects certainly do not take place outside the existing research system. But they prefer to cooperate with the Grameen Krishi Foundation to reach the farmers. She agreed that it is important for donors to keep an eye on sustainability, but that it may also be achieved in situations that do not meet the suggested conditions. The Grameen Bank itself is an example; it started small and is now active in half the villages.

Literature

- Abdullah, A.A. and A. Rahman, *Bangladesh: A case of technological stagnation*, Research Report No.110, Bangladesh Institute of Development Studies, Dhaka, 1989
- Alam, A.M. Quamrul, 'Strategies of Industrialization' in H. Zafarullah, M.A. Taslim and A. Chowdhury (eds.), *Policy Issues in Bangladesh*, University Press Limited, Dhaka, 1995, pp. 137-162
- Blackburn, J. and J. Holland, Who Changes? Institutionalizing participation in development, Intermediate Technology Publications, London, 1998
- Broerse, J.E.W., Towards a new development strategy: How to include small-scale farmers in the biotechnological innovation process, Eburon Publishers, Delft, 1998
- Broerse, J.E.W. and J.F.G. Bunders, 'Pitfalls in implementation of integral design approaches to innovation: The case of the Dutch Special Programme on Biotechnology' in C. Leeuwis (ed.), *Integral design: innovation in agriculture and resource management*, Mansholt Studies 15, Mansholt Institute/Backhuys Publishers, Wageningen and Leiden, 1999, pp. 245-265
- Bunders, J.F.G., J.E.W. Broerse and M. Zweekhorst, 'The Triple Helix Enriched with the User Perspective: A view from Bangladesh', *Journal of Technology Transfer* 24, 1999, pp. 235-246
- Bunders, J.F.G., B. Haverkort and W. Hiemstra (eds.), *Biotechnology: Building on Farmers' Knowledge*, Macmillan Education Ltd, London, 1996
- Cernea, M.M., 'Knowledge from social science for development policies and projects' in M.M. Cernea (ed.), *Putting People First: Sociological variables in rural development*, second edition, Oxford University Press, New York, 1991, pp. 1-41
- Chambers, R., *Whose Reality Counts? Putting the first last*, Intermediate Technology Publications, London, 1997
- Chambers, R. and B.P. Ghildyal, *Agricultural research for resource-poor farmers: The Farmer-First-and-Last Model*, Discussion Paper 203, Institute of Development Studies, Brighton, 1985
- Clay, E., S. Jones, A. Rahman and Qazi Shahabuddin, 'Introduction' in *Food Strategies in Bangladesh: Medium and long term perspectives*, Bangladesh Planning Commission, University Press Limited, Dhaka, 1989, pp. 1-22
- Conway, G., 'Agroecosystem Analysis', *Agricultural Administration*, Vol. 20, 1985, pp. 31-55
- Cornwall, A., I. Guijt and A. Welbourn, *Acknowledging process: challenges for agricultural research and extension methodology*, IDS Discussion Paper, No 333, Institute Development Studies, Brighton, 1993

- Dusseldorp, D.B.W.M. and L. Box, 'Role of sociologists and cultural anthropologists in the development, adaptation and transfer of new agricultural technologies', *Netherlands Journal of Agricultural Sciences*, Vol. 38, No. 4, 1990, pp. 697-709
- Guba, E.G. and Y.S. Lincoln, *Fourth Generation Evaluation*, Sage Publications, Newbury Park [etc.], 1989
- Haverkort, B., J. van der Kamp and A. Waters-Bayer (eds.), *Joining Farmers' Experiments: Experiences in Participatory Technology Development*, Intermediate Technology Publications, London, 1991
- Hippel, Eric von, *The Sources of Innovation*, Oxford University Press, New York, 1988
- Hossain, M., *Agriculture in Bangladesh: Performance problems and prospects*, University Press Limited, Dhaka, 1991
- Islam, N., 'Food strategy and development in Bangladesh' in Food Strategies in Bangladesh: Medium and long term perspectives, Bangladesh Planning Commission, University Press Limited, Dhaka, 1989, pp. 37-50
- Jabbar, M. Abdul and Md. Zainul Abedin, Bangladesh: The evolution and significance of on-farm and farming systems research in the Bangladesh Agricultural Research Institute, OFCOR Case Study No.3. International Service for National Agricultural Research, The Hague, 1989
- Leydesdorff, L. and H. Etzkowitz, 'Emergence of a triple helix of university-industry-government relations', Science and Public Policy, Vol. 23, 1996, pp. 279-286
- Nonaka I. and H. Takeuchi, The Knowledge-creating Company: How Japanese companies create the dynamics of innovation, Oxford University Press, New York, Oxford, 1995
- Pretty, J.N., A Trainer's Guide for Participatory Learning and Action, International Institute for Environment and Development, London, 1995
- Reijntjes, C., B. Haverkort and A. Waters-Bayer, *Farming for the Future: An introduction to Low-External-Input and Sustainable Agriculture*, The Macmillan Press Ltd, London, 1992
- Schot, J. and A. Rip, 'The past and future of Constructive Technology Assessment', *Technological Forecasting and Social Change*, Vol. 54, 1996, pp. 251-268
- Scoones, I. and J. Thompson, *Challenging the Populist Perspective: Rural people's knowledge, agricultural research and extension practise*, IDS Discussion Paper 332, Institute of Development Studies, Brighton, 1993
- Shah Alam, *Annual Report 1998*, Grameen Krishi Foundation, Rangpur, 1998
- Ullah, M. *Land, Livelihood and Change in Rural Bangladesh*, University Press Limited, Dhaka, 1996
- UNDP. *Human Development Report 1997*, Oxford University Press, New York and Oxford, 1997
- Van Veldhuizen, L., A. Waters-Bayer, R. Ramirez, D.A. Johnson, J. Thompson (eds), *Farmers' Research in Practice: Lessons from the field*, Intermediate Technology Publications, London, 1997
- Wilber, K., *Sex, Ecology and Spirituality,* Shamabala Publications Inc., Boston, 1995
- Wilber, K., *The Marriage of Sense and Soul: Integrating science and religion*, Random House Inc., 1998
- Williams, R. and D. Edge, 'The social shaping of technology', *Research Policy*, 25, 1996, pp. 865-899.
- Zweekhorst, M.B.M., J.E.W. Broerse and J.F.G. Bunders, 'Facing the challenge of social purpose enterprises: The strategy of a Bangladeshi NGO in combining social and economic benefit', Paper for the M&I Conference to be held in Australia, September 2000, Dept. Biology and Society, Vrije Universiteit Amsterdam, 2000

Knowledge for Development: The World Bank report[1]

Lyn Squire

1. Summary prepared by Marijke Veldhuis

In his welcoming word, George Waardenburg pointed out that 'knowledge' is broader than the 'results of research', but with a little stretch of the imagination this lecture can still be fitted within the title of this series.

Lyn Squire's lecture was based on the World Bank Report *Knowledge for Development.* Some people might think that 'knowledge' is too abstract a concept for a World Bank report, but the Bank has come to realize that knowledge can make the difference between poverty and wealth. The question to be addressed in this 'information age' is therefore, how can we share the world's knowledge with those who need it most?

In 1960 Ghana and Korea had similar levels of per capita income. Now, Korea's per capita income is six times that of Ghana. It is estimated that at least half of this difference is due to better use of knowledge in Korea.

Studies show that infant mortality rates have a stronger correlation with an increase in knowledge than with an increase in income.

Knowledge for Development distinguishes between 'technical knowledge' (know-how) and 'knowledge about attributes'. Poor countries have less technical knowledge than industrialized countries. This may be knowledge about nutrition, birth control, engineering, accounting, etc. In this respect there is a 'knowledge gap'. Knowledge about attributes, on the other hand, is about information on the quality of goods in the market, about creditworthiness, etc. Here it is not possible to speak of a 'gap' with the industrialized countries, since this kind of knowledge can only be generated locally.

In line with the two types of knowledge distinguished, the report proposes a two-pronged development strategy:

1. Narrowing the (technical) knowledge gap

This has to be achieved by improving the capacity to acquire, absorb and communicate knowledge.

Acquiring knowledge

80% of all investment in research is made in industrialized countries. Developing countries can benefit from this research through foreign direct investment, which bring new ideas, through licensing and through trade. However, locally developed knowledge should not be neglected.

Absorbing knowledge

Because economic activities have become increasingly knowledge intensive, education is more important than ever, and all higher education needs to be given greater attention.

Communicating knowledge

The cost of communication has decreased dramatically, but unfortunately many people have no access to communication media. One reason is that in many countries these media are in the hands of inefficient state monopolies. Ghana has managed to overcome this situation but is not yet reaching the poorest. Chile, on the other hand, subsidizes private operators and has succeeded in supplying means of communication to all rural areas.

2. Addressing information problems

Examples of information problems can be found in the areas of finance, environment and poverty. The type of knowledge required here cannot be imported, it has to be locally produced. Rich countries have special institutions to address information problems but in poor countries, these institutions are less well developed.

Finance

The recent Asian crisis is a stark illustration of lack of information on, for example, which banks are sound and which are not. Because depositors cannot distinguish between sound and unsound banks, they withdraw funds from all of them. One solution to this problem is standardized accounting and accounting information. There is a need for institutions providing this kind of information. In Argentina now, the central bank offers the balance sheets of all the major firms online for investors to review.

Environment

A lack of reliable information can have very serious consequences in this sector. In Indonesia the government introduced a system of colour categories indicating to what degree firms pollute the environment. This makes it possible for the public to place polluting firms under pressure. Information on environmental standards has resulted in variations of up to 25% in the share prices of heavy polluters and clean industries in countries like Mexico, Chile, Brazil and the Philippines.

Poverty

Creditworthiness is a crucial issue for poverty alleviation. It is very expensive to establish the creditworthiness of poor people, with high administrative costs for small loans. Ways to guarantee creditworthiness, such as the group lending practised by the Grameen Bank in Bangladesh, bring interest rates down to more reasonable levels. Micro-credit, like that provided by the Grameen Bank, now reaches 10 million people throughout the world.

How can international institutions help?

International institutions can help by:

a) creating global knowledge

b) devising systems for sharing development knowledge

Creating global knowledge

As one example, the World Bank is involved in the production of a cheap HIV/AIDS vaccine for low-income countries by creating a guaranteed market which will attract firms to invest.

Devising systems for sharing development knowledge

Every project, successful or not, yields knowledge on what works and what does not. The World Bank is starting up a knowledge base which will be accessible by 2000. The World Bank will also move from being a lending bank to being a knowledge bank.

Mr L. Squire is Director of Development Economics at the World Bank.

Discussion

The discussant, Mr Ad Koekkoek of the Ministry of Foreign Affairs, said he was impressed by the wide scope of the analysis of the report. He made the following remarks:

- The concept of knowledge is used in too many ways in the report: knowledge for economic growth, knowledge of markets, knowledge of standards, information for verifying quality, knowledge about the environment.
- The report seems more focused on conditions for the perfect functioning of the market than on knowledge. It does not address questions like: 'Is is our priority to close the knowledge gap between rich and poor countries, or is progress in poor countries sufficient?' or: 'Is it more important to deal with the knowledge gap than with the income gap?'
- Is it true in general that opening up of markets will bring new knowledge? Low-income countries do not produce many information-intensive products, so open markets and licensing may not bring much knowledge.
- Referring to a statement by Mr Squire that there should be heavy investment in higher education because of the high knowledge content of modern production methods, Mr Koekkoek stated that in his view, primary education is more important than higher education for developing countries.
- What the report says about the role of information and communication technology should have been elaborated more. The role played by databases, Internet, communications infrastructure should have been discussed, as well as the 'hype aspect' connected to many of the developments in this field.
- The World Bank report is more about 'information' than about 'knowledge'. Its title should have been: 'Information for poverty reduction'.

Responding to these points, Mr Squire agreed that the report is less well drafted than previous World Bank reports, because the issues are not so well researched and there is not such a solid body of literature. Mr Squire's own priorities for knowledge and information would have been in the areas of education, access to credit, and access to communications. Plans for the World Bank databank are to categorize knowledge according to the degree to which it has been reviewed. The World Bank is also working hard to help develop research capacity in developing countries. The Bank now clearly realizes that aid in the form of finance is not always right, that a combination of knowledge and finance is better. As to whether the report is more about 'information for growth' than 'knowledge for development', he stressed that knowledge and information are both important.

The discussion with the audience raised the question why the report does not deal with the relationship between knowledge, on the one hand, and power and good governance on the other. Mr Squire agreed that governance and corruption have a bearing on the use of knowledge, but the World Bank is only just starting to deal directly with such issues. It does encourage the proliferation of free media. Another question concerned the World Bank's investing so much in its own research vis-à-vis institutes for development studies, which are in crisis in many developing countries. Mr Squire pointed out that the World Bank is also involved in disseminating knowledge that is created in the less developed countries. The issue of indigenous knowledge was brought up. It plays a role these days in a number of departments in the World Bank, but are attempts being made to integrate it into mainstream

bank operations? Mr Squire responded that indigenous knowledge is being integrated in the design of many projects. Studies of donor-financed water systems have shown that 7 out of 10 realized with the input of local knowledge function well, whereas this is the case with only 1 out of 10 realized without local knowledge. One of the participants felt the report treated knowledge as a commodity that can be moved around at will and asked whether it does not also include a 'meaning' component, which makes is not 100% transferable and which implies that knowledge should always be developed locally? Mr Squire wondered whether this was true: electricity was developed in the USA but is usable everywhere. The audience suggested that the report treats the local context too lightly. To send everybody to Princeton to gather knowledge is not a solution: local capacity is needed to process knowledge. The report does not have a chapter on capacity building. It was suggested that, if Rwanda had had sufficient research capacity, the disasters there might have been avoided. Mr Squire replied that the report gives a lot of attention to the value of local information (e.g. research on charcoal stoves in Uganda; ways to introduce oral rehydration therapy) and stresses the importance of education.

The utilization of research results: the case of policy reform in India

Arjun Sengupta

The previous lunch lectures in this series have covered many different aspects of the problem of utilizing research results. The main issues were very succinctly summarized in Professor George Waardenburg's lecture. I shall try to build upon that, looking at it mainly from the point of view of the social sciences, and narrowing it down even further to questions regarding how research results can help:

- in deciding on what policies to adopt
- in designing these policies appropriately
- in 'selling' these policies, or making them acceptable to the political authority ultimately responsible for policy in a democratic system.

I am narrowing the sphere of my discourse down to these limited questions, partly because I have some direct experience in dealing with such issues, both at the Indian Planning Commission of which I was a Member Secretary (an administrative appointment) and then a Member (a political appointment) for about 5 years, and also at the IMF, first as an Executive Director, then as a Special Adviser to the Managing Director. I had the privilege, in these positions, to gain something of an insider's view of the problems of policy-making, as an administrator, a political functionary and as an international civil servant, and I thought that it may be some interest for you to share my experiences.

Value for money

In addition, I also think that such a narrow focus helps us to discuss the points raised by Barend van der Meulen and Arie Rip about 'value for money' for the sponsors of research, particularly donor agencies. Fundamental research, whether in the natural or the social sciences, is like investment in mother machines to produce more machines, which will eventually produce final goods - if you will allow me to use an economist's lexicon. It is the final goods which have a clear market value, while the value of the machines that make them is derived from that; the value of the mother machines, in turn, is derived from that of the machines. Depending upon the process of transmission and technical and commercial risks and uncertainties, the value of the mother machines can be quite uncertain, if not indeterminate. So the value for money of basic research can be very high but also very uncertain, and that uncertainty may bring down the risk-weighted value for money. If donor countries do not like to finance that research - which I think they should, because basic research is essentially a public good which has to be largely financed by public money - many developing countries may not be able to conduct it at all. But if 'value for money' were the guiding principle, donors would have to look for pointed and applied fields with a narrower focus, applying probably Carol Weiss' seven models to choose among them.

To focus my discussion on policy modelling which in effect comprises all the seven approaches of Carol Weiss, let me consider the prototype of a policy-maker in a democracy. He may have his individual policy goals, based on his ideology, but he will have to accept only those goals which the political authorities believe the electorate will support. Indeed, he will be in constant dialogue with the authorities to appreciate the political and electoral constraints and define problems clearly that they would normally only perceive as vague concerns. In fact, the policy-maker's first major contribution is to define the policy problem itself, and through that process he can influence not only the thinking of the authorities but also policy-making itself.

The policy-maker, the researcher and the political authority

The policy-maker in this model is different from both the researcher and the decision-taker, which is the political authority. In practice, all three roles can be combined in one, but it is useful to examine them separately to appreciate the dynamic of their functions. The researcher looks at an issue, for its own sake, to understand its nature and connections with other issues, to examine how it evolves in a concrete situation at a particular point of history. This function is sometimes described - with a degree of flamboyancy - as 'finding out the truth', but for our purpose it is sufficient to describe it as 'trying to understand', whether this means that the truth is discovered or not. For the policy-maker, understanding the issues however is very important, especially how they interconnect, if he is going to influence either the authorities or the course of policy-making. The service provided to him by the researcher is therefore indispensable, and he will always make use of good research work, provided it is related it to his concerns.

The policy-maker's concerns of course go beyond just understanding the real world or the issues and their interrelations, so that he can define the problems for the authorities. He has also to design solutions with the maximum probability of implementation. That probability depends on two factors. First, the policy must have a high chance of

solving the problems as perceived by the authorities. Secondly, the solutions must be 'saleable' to the authorities, who must not only appreciate the high chance of success of the policies but also see them as contributing to their political interest. The first is related to the technical characteristics of the solutions or policies - whether they present the optimal or most efficient way of solving the problems. The second is related to the political acceptability of the solutions - whether the majority of the interest groups affected by the problem would gain something from the solutions which they would otherwise not have gained. The political support of the authorities depends on the extent of interest group support, which often leads to a policy choice which is technically second or even third best, because not enough support could be built around the best or optimal solution.

In that situation, if he wants his research to be most useful, the researcher must go beyond the technical aspects of the problems and their most efficient solutions, to explore alternative profiles of possible solutions and their trade-offs and methods of implementation. Such 'scenario studies' or models can trace out alternative paths for the different endogenous variables, with different values for exogenous factors. I do not think that the researcher should actually do the job of the policy-maker; that would be asking too much. The policy-maker has to be politically sensitive, to pose the solutions to the political decision-makers, who may decide on what is in their best political interest. But he must derive maximum help from the researcher's scenario models, which trace out the implication of policies in full, to highlight the trade-offs and to guide the political authorities in making the decisions. The technocrat policy-maker must know the language of the researcher and the political authorities, but he must have with him the results of research to be able to converse with the authorities and influence their decisions.

The illustrative case of the Indian reforms

Let me now try to illustrate my points with some cases from the real world, to bring out the usefulness of research and how this could be improved upon. First, consider the economic reforms in India, introduced in 1991. In common parlance India's reforms are associated with the package of policies the Indian government announced when it faced a severe balance of payments crisis in 1991, following the Gulf War, when the country's foreign exchange reserves fell to only about two-weeks' imports and India had to hypothecate its Reserve Bank's gold to stave off a possible default on its payments. This package of policies, associated with an IMF programme, followed the usual course of deregulation of the internal market, liberalization of foreign trade and investment and, and exercise of fiscal restraint. Very few of the policies were completely new in India - they had all been tried in different degrees and at different speeds. Indeed India's regulatory and import substitution regime had already been set on a path of reform in the early 1980s, again backed by an IMF programme, which had an unmistakable impact on India's growth and productivity performance. The trend rate of growth of around 3.5% a year in the first thirty years from 1950 to 1980 was pushed up to about 5.7% a year between 1980 and 1988-89. The reforms of the 1990s raised growth rates even further to about 6.5% a year, but the eighties break in the trend rate, known as the Hindu rate of growth, was decisive. The main new element in these reforms of the 1990s, however, was that the different measures were introduced all together, as a package, so that they could mutually reinforce each other and make the programme a success.

How was that possible? For several years, Indian researchers had been pointing out the crippling effects of the regulatory policies on Indian industries and agriculture. Although, in academic circles, the advantages of industrialization based on import substitution and the planned allocation of investible resources and executed largely through public enterprises were still being debated without a definitive outcome, the policy-makers and the senior technocrats in the government were more or less convinced that the prevailing regulatory regimes were unworkable - they were neither producing efficiency, nor generating distributive justice. The technocrats in the finance and commerce ministries were pleading for relaxation of controls, and the Planning Commission was pointing out that a rigorous policy discipline was required for successful planning, a discipline that the government was virtually incapable of following. The political authorities, however, were reluctant to change because the vested interests that had developed in the earlier regime would naturally resist, and there was not enough evidence that the gains from liberalization would be sufficiently widespread and substantial to generate new coalitions to overcome this opposition, made up of interest groups and of those who might lose their jobs or be vulnerable to the process. In hindsight

there was a deficiency in research here. There were many studies that spelt out the adverse effects of the regulatory regime, but there was not much research on the positive effects of deregulation or how liberalization could be carried out in such a manner that the losers could be persuaded that they would eventually be fully compensated, if not patently benefit.

The policy-makers, who were by and large convinced that the regulatory ('licence-permit') regime was unworkable could not persuade the political authorities to take the plunge and give it up in one go, lock stock and barrel. They nevertheless wanted the system to change and kept introducing deregulation and liberalization reforms at every opportunity, gradually selling them to the interest groups and political authorities. In 1981 India persuaded the IMF to support an adjustment programme as a contingency support mechanism - as the country was not facing much of a balance of payments problem - and it adopted a series of liberalization programmes on the assumption that it might suffer a balance of payments problem as a result, which would need external support that the IMF was ready to provide up front. In the event, India's reserves position improved so much that it stopped drawing from the Fund's programme support in the middle of the period. Nevertheless, the reform programme of the 1980s remained incomplete and non-comprehensive, with the fiscal deficit becoming a serious problem towards the second half of the decade.

In 1991, the Indian technocrat policy-makers got another chance to introduce comprehensive reform, as we have mentioned above. But the point to note is that the specific crisis, which the reform package was intended to resolve, did not require the adoption of comprehensive reform. The crisis was essentially one of liquidity, created by a mismatch of receipts and payments and a temporary rise in oil prices which corrected itself within a short period. Temporary liquidity support from the IMF or central banks, with Indian gold as collateral, was enough to get over the crisis. But Indian policy-makers took advantage of the situation and introduced the programme of reforms for which they had been waiting so long. The political authorities also found it convenient to confront the opposition, comprised of vested interests, in the name of fighting the crisis. This helped the reform process to survive the substantial import compression of the first two years with a drastic reduction in the growth of output. The economy turned around by the end of the second year, with a sea-change in the attitude of both policy-makers and their political superiors in favour of reforms.

Areas of research

In terms of the model that I have traced out above the success of the researchers was in the first phase of policy reforms, in defining the problems and identifying solutions to the crisis in the regulatory regime. The policy-makers made full use of the research results to persuade the political authorities to give up the regulatory policies in their own interest. I do not think that there would be many people in India in the middle 1990s who would want to restore the licence-permit regime. This is undoubtedly a major achievement. Unfortunately, however, I cannot say that this was the case with the next two phases of the reforms. Research on designing the reforms and on their saleability, acceptability or legitimacy had little success. As a result the reform process has become bogged down in problems calling for painstaking research and policy-makers' efforts to build a new consensus.

The problem of designing reforms lies in sequencing the different elements and intensifying their effects, so that they reinforce each other and move the economy on a trajectory of high growth and productivity. As yet, the reforms of the financial sector and the public enterprises, and of the legal framework covering wage and labour law, intercorporate relations and competition have hardly got off the ground, while there has been little progress in fiscal consolidation of both the central and the state governments. Anybody looking for research subjects that would give value for money should take up these areas. Policy-makers would find well-researched findings in these areas immensely useful in helping them design reform policies that can deal with different contingencies and thereby improve their chances of success.

The third area of research, however, is even more important: to work out the saleability of the policies to the political authorities, who are ultimately the decision-takers. This area encompasses political economy, the interactions of the interest groups and the principles of social development cementing support from civil society. Since the modern theory of investment regards social stability and the sustainability of policies as crucial determinants of investors' willingness to lock in funds in projects for a long period, irrespective of their potential rate of return,

understanding the problems of social development and adopting appropriate policies for effecting such development would be crucial to the success of the programmes. Policy-makers would use the research results to devise policies in a way that legitimizes this acceptance by most of the people and persuade decision-makers to adopt them in their own interest.

These are very difficult areas of research and in India the reform process suffered serious setbacks because there was not enough popular enthusiasm or political support for them. They could not be sold to the electorate as a programme that served their interests, or as pro-poor or favouring the underprivileged who constitute the bulk of the voters in the Indian democracy. On the face of it, a programme of reforms that builds on liberalization of the markets with their unequal distribution of bargaining powers related to disparities in wealth and income, and the requirements of fiscal austerity to maintain macroeconomic stability would appear to be anti-poor and pro-rich. If concurrent action cannot be taken and appropriate policies are not adopted to prevent growth disparities and alleviate the conditions of the vulnerable, it will be very difficult to persuade the political authorities to carry on with the policies of reform.

A related though not identical area where research results could be very useful for the policy-maker is provided by recent experience with planning in India. It is no longer possible to plan by decree or allocate investment by fiats issued to the public sector organizations. It is essential to use market-based incentives to persuade market actors, even corporatized public-sector enterprises, to act themselves to further social goals. To achieve this it is first necessary to build up long-term development perspectives for the economy (for a period of say 15 years) and then construct short or medium-term projection models and policy scenarios that bring out clearly the feasible policy alternatives.

The Indian Planning Commission has launched a research project, with the help of the Netherlands Planning Board, to build up such projection models with possible alternative scenarios based on changing policies. Considering the enormity of the country and of the problems, this is an enormous project that has to be approached step by step, perfecting the tools and improving the specifications of the models at each step. Once the research on the development perspectives has been successfully carried out, it will be necessary to design policies to ensure the participation of the decentralized agencies to execute the programme.

Legitimacy of the policies

Finally, however, there is the question of the legitimacy of the policies and public acceptance of their usefulness. That would open up a wide area of research to facilitate the implementation of planning - how different agents responded to different incentives and how their activities could be coordinated to realize national goals. India's Ninth Five Year Plan made a start with this process. With a 15-year perspective of development it built up alternative scenarios with different sets of policies based on relative prices and incentives in a fast globalizing market economy. Such scenario models could also indicate the implications for fiscal and monetary policies if the government chose to make larger allocation of expenditure in the social sectors, such as education, health, sanitation, rural employment and poverty alleviation. There are always trade-offs between different objectives of policies within the overall budget constraints. But until the trade-offs are clearly spelt out, policy-makers cannot choose between the alternatives, whether to spend one rupee more on, say, education or whether to reduce taxes by one rupee to enable the individuals to spend one rupee more on consumables. This may have to be supplemented by research on how best to implement the social programmes, and how to make one rupee spent on, say education actually deliver one rupee worth of benefits. Only with the results of such research can policy-makers build up support for their policies. The legitimacy of policies in a democracy can be secured only through informed discussion and public support, to build up a favourable consensus.

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How can poor people benefit from research results?

Sheela Patel

Research is an essential activity which has a great deal of value for the communities of the poor, who are generally treated as 'subjects' of research. Often, the right to create, use and develop tools to appropriate knowledge are not available to all. Development intervention often gives resources to some and not to others, thereby creating unequal rights to undertake research. In a globalizing world with interconnectivity, there is potential not only for a wide spectrum of people doing research to work together, but for a range of strategies through which the research undertaken by different groups using varying techniques can be linked to produce new insights and knowledge that earlier types of research activity could not produce.

SPARC stands for the Society for the Promotion of Area Resource Centres. It is an NGO which I set up in 1984, along with 12 other people who had been working on issues of urban poverty. We felt at the time that what we were doing was somehow not addressing the real issues of poverty and inequity in cities, that we needed to develop more effective ways to work with rather than for poor communities, and to try and find sustainable strategies which poor communities themselves can use to address their aspirations and problems. We had no fixed plan and no resources, only some insights from our earlier experience to guide us.

Ideas

What were these insights? We had learned:

a that cities operate as geographical areas, and poor communities locate themselves in physical spaces which suit their vital activities; this should be kept in mind when working with these communities. The area resource centre concept sought to create a space which would provide facilitating conditions for those beginning to participate in exploring what they wanted.

b that nothing trickles down, so starting to work with the better-off in poor neighbourhoods, cannot lead to a solution that has universal application; instead if you begin to work with the poorest communities and create a solution that works for them, this solution can be used to help others.

c women in poor communities are the innovators and managers of all meagre resources. In fact the poorer the community the more the women are in charge of the process. If you begin to work with the poorest communities, the chances are that women can participate centrally in a process of change, and when they participate in these transformations, it creates internal equity management in a way that no other system can.

Therefore, we began to work with pavement dwellers in Mumbai[1] in the E ward (the district with the largest pavement slums in the city) and began a dialogue with women in these communities.

Invisible

As we began to work with pavement dwellers, we began to realise that the communities who reside on the pavements were an invisible population not only for the city administration, but also to the rest of the city and, unbelievably, even to the communities themselves.

What does being invisible in the city mean? Cities are dense spaces managed on a day-to-day basis by their municipal councils, the lowest arm of the state, which provides services and amenities. Its 'governance' organizes water sanitation, housing and other services on a massive scale for a 'population' that resides in the city. Statistics are a means through which planning is done, and cities, especially those in the south of India, tend to plan for the citizens who live in formal housing, attempting to ignore, and thereby not cater to, those who live in informal settlements.

Until the 1970s all informal settlements in Indian cities, especially in Mumbai, were thus ignored. However, as their ratio increased and they began to get the right to vote, they became valuable vote banks, and a trickle of services began to flow into the slums. The city began to use their labour, but first did not consider it their responsibility to develop a city plan to house them and provide them adequate services. While this situation gradually began to improve, it did not change for the people residing on the pavements.

Although historically all migrants who came from the rural areas in search for work 'squatted' close to where they would get work, those who by accident squatted on pavements lost out because the municipality decided that these people could not be included in municipal services. They not only ignored them but constantly demolished their houses in the hope of evicting them. This led to a war of attrition between the municipality and the community and impoverished the pavement dwellers because they kept rebuilding their humble houses. The houses were reconstructed with soft,

1. Mumbai is the new official name for Bombay.

perishable materials and needed refurbishing each year, even if the dwelling was not demolished. They were constructed this way so that, when the dwellers heard of impending demolition they could dismantle their homes. This insecurity thus created conditions for investment in their homes which never really got upgraded. And there never seemed a possibility that the state and the municipality would work together to re-house them elsewhere.

Survey

SPARC personnel started to understand the vicious cycle which kept these communities at the bottom of the city's population. We began to see that the other poor people in the city who were better organized also ignored the pavement dwellers. There was no organization to represent them, no networks with other communities. There seemed no way out for these families, whose life in the village was over as they had no land, no home and no work.

In 1985, the Supreme Court of India passed a judgement which allowed the municipality to evict pavement dwellers and this created the kind of hysteria and panic in the settlements which cut through the apathy and despair. SPARC, still a new and fledging organization itself, started, together with the women it had begun to work with, to look for ways to deal with the crisis. Everywhere we went there were myths about pavement dwellers which did not match what we knew to be the reality of how they survived in the city. Reputed research institutions and municipalities were not inclined to study their problems and understand who they were; they did not feel it was possible to do so.

SPARC then decided to do a survey. With no financial resources and very little time before the eviction date, we gathered college students and community leaders, and tested a questionnaire in which we asked questions about the pavement dwellers: where did they come from, when and why had they come to the city, what work did they do here and what did they do before in the village?

In three months we undertook a census of about 6000 households residing in E ward and the three main arterial roads of the old city. The results of the survey were dramatic: most pavement dwellers were from the poorest districts of the country; they were landless agricultural labourers and artisans who had no property or assets in the village; they had come over 20 years ago (in 1985), and more than half the population (more than the national average) worked, and yet earned less than a minimum wage. Most walked to work as a means of subsidizing their transport costs, so staying near the place of work was essential.

The survey did not ask 'how do you feel about' questions that reflect opinions, just collected the basic facts which demonstrate in quantifiable terms the circumstances of these people. All interviewees made sure they were present when the questions were asked, and that the answers were accurate, as it was clear that it was a representation of their reality… a tool through which they were talking to the rest of the city.

The report had major impacts. The most significant was on the communities themselves, which now began to see themselves as a group with common needs and aspirations and began to explore the possibilities of organizing themselves. They no longer saw themselves as 'alone'; the empowerment that results from such an exercise needs to be stressed. They began to understand the politics of cities: if you are not counted then you are invisible and cannot ask for your entitlements.

Researchers and practitioners at institutions and NGOs, who had hitherto not seen these people as a 'population', now began to do so, and increasingly began to include the pavement dwellers as a category among the poor. Interestingly, in the past, all resources allocated by the state to the poor excluded the pavement dwellers. Now there were demands for their inclusion, because the survey demonstrated that they were indeed the poorest and the most vulnerable.

Although we were unable to stave off mass demolitions, everyone who had protested, the women's collectives and the communities, had gone into a higher gear and were asking 'what next?'. The women emphatically said they now wanted to make sure they got a house. They asked whether SPARC could give them houses. We said we didn't know anything about housing, but, instead of despairing or asking someone else to tell us, we decided to 'research' this housing business. The women knew and we knew that we could not give each other any assurances, but that we would explore this problem together.

Federation of slum dwellers

The National Slum Dwellers' Federation, NSDF, was set up by slum dwellers in 1975. In the twenty

years preceding that, like pavement dwellers, many slum dwellers had faced demolitions and evictions and had begun to get frustrated at the activities of NGOs who came to provide health care or education, but did not want to address issues of land security and tenure because they felt they could not secure it. Yet, as far as the poor communities were concerned, this remained at the heart of their problems. Without a secure physical address, there can be no consolidation of assets and no security. If there is no security there can be no creation of assets or wealth.

So in response the slum-dwellers formed their own federation and worked towards their goal of mainstreaming issues of urban poverty in city issues. The federation leadership followed the SPARC survey with interest. The concept of gathering data about the poor and the pavement dwellers was similar to their own strategy. But the combination of community and professionals was new, creating the conditions for information to reach places where poor communities alone could not take it.

The federation and SPARC explored a possible alliance. SPARC wanted to maintain its commitment to women and to developing strategies with the poorest. NSDF represented a huge network of slums whose political and mass base would help the cause of the pavement dwellers who had so far been excluded. Together they agreed to establish a third organization, Mahila Milan, which would create systems and mechanisms for women's collectives to build skills and credibility to work in local communities. Originally, Mahila Milan was what the women from E ward who wanted to explore the housing process called themselves. Now, many women groups form part of Mahila Milan and are trained to manage community affairs. They are also the major managers of data and information in the communities and provide information to the alliance.

Housing research

The alliance of SPARC, Mahila Milan and NSDF undertook research on the issues of housing for pavement dwellers and began to understand why poor people can never get a house, why all housing for the poor is taken by others and how the design and construction strategy developed by professionals for the poor not only excludes them in all aspects of planning and execution but is also dysfunctional to the needs and financial capabilities of the poor. Thus a strategy designed for the pavement dwellers now began to make sense for all slum dwellers and within a matter of ten years the alliance had begun to work in 28 cities in 6 states and had a membership of 350,000 households.

This research placed the alliance in a central position to challenge the state's information about the poor. For every strategy formulated by the state, the alliance could not only produce counter arguments, but could demonstrate a better working alternative. More censuses of specific populations were undertaken (Dharavi Census of structures 1987, Beyond the Beaten Track 1988) by the alliance which demonstrate how poor communities can not only gather information about themselves, but can challenge the inaccurate and spuriously inadequate information that the state uses for reallocating resources for the poor in cities. This began to change their self perception and their relationship with these institutions.

International network

In 1988, along with several other grassroots NGOs in Asia, we founded ACHR, the Asian Coalition for Housing Rights. Through this regional institution we could make sure that our voices reached Asian forums where international and national agencies discussed issues of urban poverty and the poor. We were able to share our experiences and help each other with strategies, and we also began to explore linkages with other institutions which did research, or undertook projects on urban poverty issues. For instance, in Cambodia, NSDF, SPARC and Mahila Milan recently began to work with informal settlements of people who fled to rural areas during the war and had now returned and lived in slums and on rooftops. The Slums and Urban Poor Federation of Pnom Penh now works actively with the municipality to develop alternative housing, exploring ways in which the resources of the poor and the city, together with international aid, can help provide the poor with urban facilities and amenities.

In 1991, we linked up with the newly formed organizations in South Africa that were beginning to examine what was to happen in South Africa after majority rule (People's Dialogue for Land and Shelter, and South African Homeless People's Federation). Using the experience of the poor in India, we began to share with them the harsh facts that democracy does not automatically give you the right to have a house and job. What it does, is give you equal opportunity of assembly and advocacy through which you can make demands on the state

for the use of its resources to fulfil your aspirations. Initially this was not believed, until the leadership actually came to India and saw the situation of the poor. They also saw the tools which the Indian poor communities aligned with NSDF used, the most powerful ones being enumeration and savings. Applying the strategies we use in India, the South Africans began to enumerate black townships and federate settlements, and when the majority rule came to South Africa, they began a dialogue with the government to seek land tenure, amenities and services for the poor. Through these censuses they gathered information about townships where previously, there had been either no data or inaccurate data. Moreover, this information was available to the poor themselves and they set up organizations that became acknowledged as the representatives of the poorest of the poor in the townships all over South Africa. Nowadays, the South African Homeless People's Federation cannot be ignored when policies on resource allocation and other aspects affecting the poor are formulated and executed.

Now, national federations of the poor from 11 countries form Slum Dweller's International (1996), through which they exchange strategies and help each other strengthen their local presence and voice their concerns in a global policy environment.

Slum dwellers in India and the World Bank

These international linkages and exposure, coupled with the confidence and capacity to conduct focused research along with communities, has helped to make the alliance a strong contender in development, as the Mumbai Urban Transport Project II (1995-97) demonstrates. MUTP II is a World Bank project in which the government of the state Maharashtra and the central government Department of Railways jointly borrowed money to improve the public transport system of the city of Mumbai. The scheme seeks to lay out additional train tracks, to improve the efficiency of the present train services, to improve road and public bus systems, and so on.

It was estimated that over 35,000 households would need to be relocated, most of them squatters and slum dwellers. The World Bank, which has a very stringent set of norms to guide such involuntary resettlement, suggested that the state develop a policy for this resettlement and rehabilitation. SPARC and two other NGOs were on the committee to prepare the policy. The entire process of how to design baseline research, who should do the survey and how, was recommended by SPARC, on the basis of its work with pavement dwellers who plan their own relocation. The policy is commonly known in Mumbai as the Sukhtankar Committee Report and is now the policy guiding the rehabilitation process.

Since 1995, when the report came out, SPARC has, together with the federation, enumerated 7000 of the households and will facilitate their rehabilitation with the active participation of the communities. There is an active federation of these households which now has both the capacity and the strength to challenge the traditional 'professional-driven' rehabilitation strategies demanding that communities, assisted by NGOs, design and execute these projects themselves.

Valuable impact

The most valuable impact of the enumeration stems from the process of participation: the building of organizations and, through that, a movement which the poor own, drive and manage themselves. The poor are often unable to combine their most valuable asset -critical mass - when seeking to obtain resources and services. Their lack of material resources and knowledge of how information drives the choices made by the state, puts them in a weak and fragmented situation. Therefore, the process of gathering factual information about households is very important; individuals and communities receive training, become 'students and learners' and build confidence and capacities to influence the process. When their real situation is seen and understood by the poor themselves, their ability to develop specific collective priorities, to identify solutions and to seek internal resources towards that solution, helps to build an organizational framework based on sound work and not on wild aspirations in leaders' minds. Thereby, the processes within the organization become focused and sound, while leadership has a clearer direction and can count on the support of the members.

One of the features which makes such federations unique is that they do not expect 'others', that is the state or philanthropy, to solve their problems. Instead, they seek to define them themselves and design the solution. To drive this process, they need their membership to understand and believe that they have the capacity to make choices and resources to invest. The enumeration provides the

information to define priorities and to design resource flows. These strategies are as new for communities as they are for professional and donor bodies, and therefore have added value in terms of project design and donor education.

They also impact the negotiating processes with the state and with institutions of civil society. The state and, very often, civil society organisations have a habit of patronizing the poor, treating them as though they have no capacity, no resources and no information. More than anything else, it is a powerful equalizer which demands respect and therefore changes the relation of the poor to the state and civil society.

The strategy has also been able to impact policy. In India, South Africa and Cambodia, organizations of the poor have come into being, which have been able to demonstrate to their international funders the need to change the manner in which resources can be used, and eventually to create a dialogue with the state on the development of programmes for the poor designed and managed by the community. In this way, the investment produces outputs which make the organizations sustainable and serve the needs of the community and society. As the strategy can be transferred, scaled up and replicated, its universal application has also been demonstrated.

There is also added value in locating the design and execution within the communities, assisted by NGOs, instead of calling in external consultants. Doing the research builds a knowledge base within the communities, allowing them to build on, upgrade and make further use of their skills. When such research is conducted solely by outsiders, the investments leave the community after it is completed.

It is useful to make the information gathered and owned by the communities available for other forms of analysis. The partnerships of NGOs, CBOs and researchers which have already occurred with SPARC and NSDF indicate that the kind of extrapolations researchers are able to make can benefit the communities and the poor by creating new insights and knowledge in the sector. However, this requires willingness on both sides to dialogue and work in partnerships.

Ms Sheela Patel is Director of the Society for Promotion of Area Resource Centres, SPARC, Mumbai.

Discussion

After the lecture, Mr Rob Visser, head of the Poverty Analysis and Policy Section, Social and Institutional Development Department, at the Ministry of Foreign Affairs, acted as discussant. He noted that there is still little insight into the causes of poverty; too much research in the last 25 years has focused on questions of definition and measurement. Economists and social scientists have come up with some answers, but in a kind of defensive and 'outsider' way: they point to lack of access to markets and credit, to shortages and lacks. The focus of his department is different from Ms Patel's, more concerned with macro processes. Bringing in the perspectives of the poor by engaging in the kind of research partnerships Ms Patel describes is important. Mr Visser suggested that both kinds of research are necessary and can be mutually beneficial. Ms Patel agreed that it is not an issue of right or wrong, and that macro research is indeed useful. She feels that there is no need for the two to compete, as each has a role in society and great potential to connect and correlate to each other. But she also points out that her kind of research is hardly recognized while the other is respected and dominant.

During the discussion with the audience, the question was posed about the validity of the research process. Ms Patel explained that there is often a perception of external research as being objective and capable of finding the truth, while internally generated information is seen as biased and false. She pointed out that all information has biases regardless of who gathers it and how it is communicated. The issue is how honest and transparent are those biases? The information gathering for enumeration is based on some very well developed rules: it never seeks opinions or makes value judgements. It always asks questions about facts. Discussion on the views of the communities, possible choices for solutions etc., take place in group meetings. When the enumeration was done, there was an internal consensus that the process *quantified* the reality of the poor, without commenting on it.

As to what kinds of details are asked about the poor, Ms Patel related that the questionnaire begins with data about the individuals, households and communities as they are located in geographical relationship to each other. The enumeration covers socioeconomic data at household level, information about access to services and amenities required for day-to-day survival and how communities obtain them, about the work people do, how much they earn and so on, and about their migration history at the household and settlement levels. Depending on the local situation, more specific questions can be added.

A question was asked about the effectiveness of resettlement: will others not replace them, leaving the poverty trap intact? Ms Patel replied that, since the MUTP II, which requires resettlement, this question has come up. The stand of the federation is that land security is vital in addressing issues of poverty and equity in relation to basic amenities in cities. Initially, most cities ignored the need to allocate land and make it accessible to the poor for housing and community life. Consequently, the community squats on whatever land it can find and slums spring up. Dealing with this phenomenon ranged from ignoring it to actively demolishing houses and evicting households. This results in depletion of poor people's resources, loss of wages and huge problems of insecurity. Research in these situations often provides the basis for designing solutions. Among the strategies used are: (a) analysis of the wastage of resources of both the communities and the state in attempting demolitions which do not provide solutions, of the implications for the relationship between the state and community and the detrimental effect on designing a long term solution; (b) exploration of the possibilities of obtaining tenure for the communities on the land they presently live on; (c) looking at what circumstances require people to move, both for their own safety as for the larger good for society, and at some of the preconditions for the solutions. Ms Patel said that explorations of this kind elicit reasonable responses from both communities and society, and although they take a lot of time, they are a valuable tool for working together in partnerships. Her final answer was that resettlement designed and driven by communities works.

In reply to the question whether institutions like the World Bank are convinced about this methodology, Ms Patel said that in principal the World Bank promotes a process aimed at developing rehabilitation which works for the community. However, the Bank has difficulty fitting such a process into their time schedules and is not used to giving resources for institutional capabilities. Procedures and strategies are more driven by professionals competing with each other for contracts; communities just become 'beneficiaries' for which everything is done in a spirit of patronage. The federations resent this and have been working to contest with the Bank. Within the MUTP II project the strategy is now gradually being accepted, and NGOs and CBOs designing and managing projects is being incorporated in the process.

Lastly, Ms Patel reflected on Northern researchers coming to the South to do research. Not all researchers, whether Northern or Southern, are the same. Their attitudes and strategies differ according to their past exposure and awareness of grassroot movements and their work. Their attitude also depends upon who funds them. When the funding demands that the communities and NGOs are involved and partnerships are encouraged, and allows communities to have equal access to resources to hire Northern and Southern researchers, the partnership often produces great results. Otherwise the Southern communities just become 'fieldwork' sites for data collection and no knowledge or information comes back.

The link between research and policy: the case of the Programme for Strategic Research in Bolivia[1]

Sonia Montaño Virreira

1. Summary prepared by Ed Maan en Eduard Jansen.

Ms. Montaño started by saying that she has more experience with research from the perspective of the user than from that of the researcher. She has been part of the women's movement in Bolivia and has been a policy-maker. Her lecture was based on the experience she acquired as chair of the management team of the Dutch-funded PIEB (Programa de Investigación Estratégica en Bolivia - Programme for Strategic Research in Bolivia) research programme.

Many factors contribute to the gap between research and policy. In her lecture she concentrated on the institutional framework. What can be done to translate new knowledge into action? What we mean by utilization is not clear, as George Waardenburg pointed out in his introductory lecture. It is unpredictable what will be done with research findings. That is positive, because it means that science does not monopolize decision-making.

What should our research be on? The politically correct answer for PIEB to give to the Dutch donor would be: alleviation of poverty and other socially relevant issues. Nevertheless our first reaction was: why should we do research on those themes? In an anti-colonial frame of mind we wanted to be free to select our own themes. During the dictatorship academic life had been all but destroyed. Social science research was limited to a few NGO activities. Bolivia has been democratic for 18 years now. That is a short period for social science to re-establish itself. Empirical social research is weak. There is a tradition of writing long essays without reference to empirical data. Collecting of data (e.g. on the abuse of women) has only been done for relatively short time-spans and for immediate use in politics. In policy-making, Bolivians use political rhetoric based on intuition. Research in and on Bolivia has mainly been conducted by Northern researchers and the ensuing knowledge has not by and large been shared with Bolivians. Therefore, PIEB's first need was to build a community of researchers which could compete with the North. Training for quality was our main aim - how could we develop a national knowledge system? Contrary to the Dutch (who are always 'so utilitarian'), we felt the link between research and policy would come naturally after a certain time.

In the four years of PIEB we have made progress in building the knowledge system and in interacting with others in a network. PIEB is a strategic research programme ('strategic' is a handy phrase to circumvent the question of utilization). What is strategic? It means considering issues of equity, participation, identity and poverty.

In the course of our programme we faced the following dilemmas:

- Researchers work too slowly for policy-makers, who expect too much too quickly.
- Policy-makers/politicians may look upon social science research as a subversive activity.
- Research findings are used by policy-makers/politicians for their own purposes, knowledge is not neutral.
- The outcomes of socially relevant research can be a threat for the institution that carries out the research.
- An individual researcher working on her own has more freedom to present independent views; on the other hand, research carried out by an individual researcher carries less weight than research carried out by an institution which can promote the utilization of its research.

In PIEB we have come to the conclusion that the issue of the quality of research is relevant for its utilization. Research has to be academically rigorous in order to be of social relevance. We had to set aside resources for research training that we could not use for undertaking research that was immediately usable in policy or action.

In Bolivia we have few full-time researchers. Most scientists have other jobs in addition to their research work. The number of post-doc positions is also limited. PIEB gives priority to developing a critical mass of young researchers. Initially, we cannot expect the outcomes of their research to serve as a basis for policies.

Nevertheless there are interesting experiences. Two research projects on educational reform came up with contradictory conclusions. Research can make an important contribution by stimulating public debate.

There is no clear demand for research (yet) from policy-makers themselves, although PIEB has had consultations with stakeholders on its research agenda. The results of current research are often not so useful to policy-makers because they fail to link local and global/macro dimensions, and have no comparative perspective. Policy-makers need insights into things like "Who has done what before?" to reduce risks.

Ms Montaño concluded with the observation that

Ms Sonia Montaño Virreira is a sociologist. She is currently chief of the Women and Development Unit, Economic Commission for Latin America and the Caribbean (ECLAC), Santiago, Chile.

utilization of research has to be seen against the background of the wider picture of Bolivia's higher education sector, which is in a profound crisis, and its political system, with all its shortcomings. Utilization can only be seen in a long-term perspective. First priority is to lay the foundations for a sound knowledge system. There are little niches of quality now, but for many tasks they still hire experts.

Her message for PIEB's donor is do not force the issue of utilization.

Discussion

The discussant, Dr Joske Bunders of the Vrije Universiteit Amsterdam, said that from the lecture she concluded that PIEB has no problems with the academic and social relevance of its activities. She would like to know how they achieved that. Did they select one or a few disciplines first and broaden up later?

Ms Bunders observed that other programmes start with the needs of the end-users. That may be a long process and it is uncertain where it might end. PIEB's approach of starting from the needs of science is also valuable. However, why did they wait four years before having interaction with end-users?

Ms Bunders also asked about the nature of the training needs that PIEB had detected. Is there need for methodology training? On a multi-interdisciplinary approach? On rapid participatory approaches?

Responding to these points, Ms Montaño said that PIEB built up goodwill by successfully completing 15 projects. Five of those have led to follow-up programmes. Initially, PIEB tried a multidisciplinary approach involving, for example, historians in addition to social scientists. However, coherence turned out to be a problem. It may be better to have good monodisciplinary research first. Most studies are practically oriented. So far, economic issues have not received sufficient attention.

Concerning interaction with stakeholders, PIEB did interact with stakeholders in the beginning when it was drawing up the agenda. Now it is interacting again. You need results in order to interact on a permanent basis. The demand for research does not arise out of society by itself. It is necessary to solicit it.

For its training activities PIEB uses the model of linking junior to senior researchers. PIEB aims for excellence in the academic sense.

From the audience there was a question if relevance and utilization are the same, or is relevance a matter of 'the eyes of the beholder' and utilization something more practical? Ms Montaño replied that she prefers to speak of 'relevance' rather than 'utilization'. Relevance to the political agenda or the social agenda is important, but not all socially relevant research can be used. Moreover, policy-making is often not a public process, particularly not under authoritarian regimes.

What about unwelcome results for policy-makers? Is a go-between/interface between policy and research helpful? Ms Montaño responded that in her opinion the interface between research and the state should be strong citizenship. There is a deficit of citizenship. Research can help to stimulate the debate.

When asked about the institutional framework of social science research in Bolivia, Ms Montaño explained that when PIEB started there was no institution to work from, it started from scratch. PIEB now interacts with universities in the region and with regional NGOs (where there are no universities or research institutes) to develop regional agendas through stakeholder meetings. The Bolivian research sector faces constraints such as insufficient library and internet facilities and a lack of state-of-the-art reviews. PIEB develops documentation centres as co-ventures with NGOs, for instance in the cotton growing sector.

In response to a request to say something about the discussion in Bolivia on investment in higher education, Ms Montaño pointed out that there is no policy for restructuring higher education in her country. The crisis in the higher education system is not caused by budgetary problems but by, for example, traditional, inefficient personnel policies maintained under pressure from strong trade unions. There is no political will for change.

Speaking from his experience in West Africa, Mr Mamadou Diouf, research director of the Council for the Development of Social Science Research in Africa (CODESRIA)[2] said that we tend to assume - perhaps incorrectly - that there is a need for research in policy circles. However, in his view there are examples of progressive niches within the state, especially in the economic and social sector (especially after the introduction of Structural Adjustment Programmes), which provide space, especially for research which is not only micro, but also macro and comparative.

2. Dr Mamadou Diouf is currently Professor at the Department of History, Université Cheikh Anta Diop, Dakar, Senegal, and Professor at the Department of History, University of Michigan, Ann Arbor, USA. He is a member of RAWOO.

The university of the 21st century: multidisciplinary science in a flexible network organization[1]

A.J. Berkhout

1. Prof. Berkhout's lecture was based on this paper

2. In the Netherlands, the humanities are referred to as the 'alpha' sciences, the natural and technical sciences are referred to as the 'beta' sciences, and the social and life sciences are referred to as the 'gamma' sciences.

Introduction

In recent years there have been increasing calls for universities to 'decompartmentalize' their discipline-oriented faculties and to pay much more attention to interdisciplinary activities. But this has proved extremely difficult to achieve in practice. Scientific quality is still almost exclusively measured by achievements in specialized research and the university organization still comprises many obstacles to a cross-faculty method of working. However, there is a more fundamental reason why multidisciplinary teams at universities do not get off the ground. The traditional approach is use financial incentives to tempt from different knowledge sectors to collaborate. Most multidisciplinary programmes are therefore nothing but a collection of individual ambitions. This situation should be seen as the logical consequence of a strategy based on the classic linear innovation model.

In this paper the urgent need for interdisciplinary scientific research is legitimized with the aid of a non-linear model of the innovation process. This entails a new vision on how universities have to deal with their interdisciplinary ambitions, where especially width is not realized at the cost of depth. The consequence is that the classic 'forward' way of acting has to be complemented by a postmodern 'rearward' approach (inversion). In addition, it is argued that the traditional university organization has to be adapted to form a flexible network with horizontal and vertical processes. This requires a not insubstantial culture shift.

Does the disciplinary university still have sufficient societal support?

Knowledge increasingly dominates our lives. Nowadays, it is impossible to imagine technical, economic and social innovation processes without scientific knowledge. The growing importance of scientific knowledge for mankind and its environment means that scientific research is no longer the exclusive domain of scientists. Society expects more and more that science will devote itself directly and indirectly to the multifaceted control issues for prosperity and well-being. For universities this means in the first place an obligation to our society to educate academics who are (and will continue to be) widely employable within the demanding professional world. But this means as well that scientific research has to be motivated not only by 'scientific impact' but also by 'societal added value'. It will be a challenge for universities to *translate* major technical, economic and social issues into fundamental-scientific formulations of problems which their top scientists wish to work on.

Coherence, coherence, coherence

Science is often subdivided into five areas (humanities, social sciences, life sciences, natural sciences and technical sciences). Each area is broken down into disciplines and each discipline consists of a number of specializations[2]. As the result of a strong emphasis on specialization in recent decades, research in the many, often very narrow knowledge segments have tended to develop a life of their own. For universities this also means little or no contact between (sub)faculties and among departments regarding content.

However, the many often widely varying aspects of exogenous problems cannot be contracted out separately to independent research communities but have to be dealt with as a coherent whole. This *system approach* often demands the combined effort of a large number of different knowledge segments. A topical illustration is the integration of many mechanical, electronic and software components, influencing each other, to form economically controllable technical systems with the desired function specifications. Another is the integration of many different physical, chemical and biological process steps to get from base materials to an end product with the desired characteristics. In these research programmes, most progress can be expected by integrating the processes at the *interface* of participating disciplines.

A university has to be more than the sum of its faculties. The big challenge for the present university management is to forge a coherent entity from the loose parts.

The above-mentioned has far-reaching consequences for future university education and research. After all, pure *lecturing* of 'loose pieces of knowledge' via a traditional university course and practicum curriculum is no longer adequate. Nowadays it is also about putting the quantity of knowledge components into order and connecting them to each other. The discovery of similarities between apparently completely different models and processes has to be seen as one of the most important components of academic formation. Such stimulation of 'lateral thinking' should be an

important element within university education *from the very beginning*.

The same may be said about university research: the pure generation of 'loose pieces of knowledge' via a traditional research assignment is no longer adequate. It is nowadays also about visibly directing the research, starting with a system concept, so that students are taught via their disciplinary research (depth) that their specialist results will have to contribute to a larger entity (width).

Cyclic innovation model

One of the most unfortunate misconceptions about innovation is the one about the *linear* model. In this classic innovation model, product innovation is described by three sequential steps: from fundamental research via applied research to product development. Unfortunately, innovation is far from a serial, relay-type process. The linear innovation model therefore portrays a fundamentally incorrect picture of reality (Barnes and Edge, 1982; Netherlands Academy of Engineering, 1994; Kealey, 1996; David, 1997).

In practice, innovation is about parallel, cyclic interactions (Berkhout, 1997; Dits and Berkhout, 2000). On the one hand there is the interaction between scientific knowledge generation ('know why') and technological research ('know how'), and on the other is the interaction between technological research and product development (figure 1). Although both types of interaction processes are very complex, both of them can be explained very transparently by two *interaction* matrixes[3]. This is shown schematically in figure 2.

In the science-technology matrix (left) the columns represent the activities in the different scientific specializations at the universities; each row indicates which of these specializations contribute to the research in one specific technology sector. Likewise, in the technology-product matrix the rows represent the activities in the various technology sectors; each column indicates which of these sectors contribute to the development of one specific (sub)product.

An effective discussion about the way innovation really takes place in our knowledge society requires a study of the multidimensional forward integration and backward steering processes as made visible by *both* interaction matrixes of the cyclic innovation model (CIM). If this is done correctly, it provides an improved insight into how to organize these processes in a multi-player environment[4]. In addition, strategic information becomes available on how to make a better choice in one's own range of products (core competence), to specifically strengthen the technology portfolio by multidisciplinary scientific research, and thereafter to map strategic alliances for the knowledge infrastructure (in figure 2 on the left) as well as for the industrial community (in figure 2 on the right).

Via various disciplines science contributes to the development of a specific technology. Furthermore, this integration process has a steering influence on the activities in the disciplinary research (feedback).
Various technologies are necessary to develop a specific product. Furthermore this integration process has a steering influence on the activities in the technological research (feedback).

3. A matrix is the scientific name for a spreadsheet.

4. Many public and private organizations are poorly suited to facilitate a high degree of interaction between their different 'business columns'.

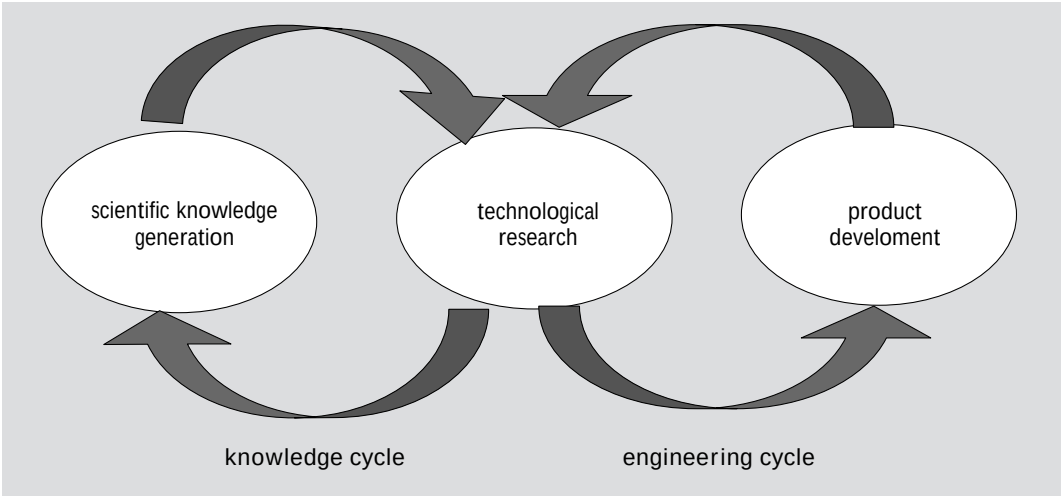

Figure 1: In practice, innovation is about parallel, cyclic interactions. On the one hand there is the interaction between scientific knowledge generation ('know why') and technological research ('know how'), and on the other there is the interaction between technological research and product development (Berkhout, 1997). Technology therefore fulfils an invaluable bridge function between the knowledge cycle (left) and the engineering cycle (right).

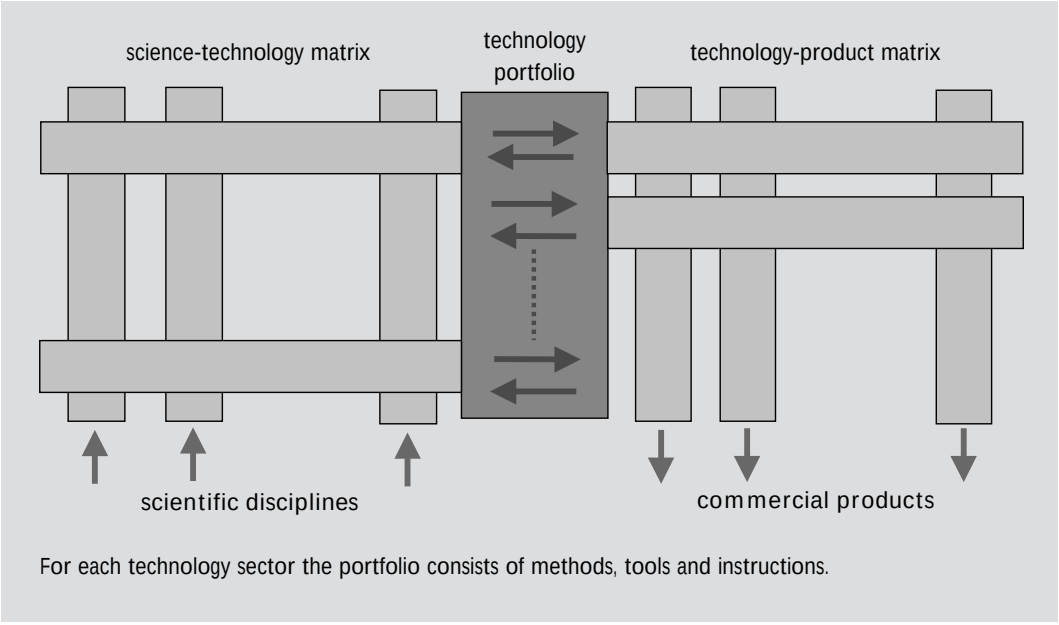

Figure 2: The left part shows that science can contribute via different disciplines to the development of a certain technology (many-to-one in the feed-forward loop). Conversely, the development of one specific technology may give direction to the knowledge generation in many disciplines (one-to-many in the feedback loop). The right part indicates that different technologies are a requisite for the development of a certain product (many-to-one in the feed-forward loop). Conversely, the development of one specific product may give direction to the research activities in many technological sectors (one-to-many in the feedback loop) (Berkhout, 1997).

The CIM indicates that scientific and technological knowledge contribute to new products via a *double* integration process. This means that the generation of 'loose pieces of knowledge' via the traditional linear approach is out of date. After all, it is increasingly about steering scientific as well as technological research from a system concept (coherence). For scientific research, this means that scientists should be fully aware *during* the research process, and not only afterwards, that their specialist results have to contribute to a larger entity.

Furthermore, in the past, scientists strove far too much for more of the *same*: cooperation among the same disciplines. This is certainly useful but will not generate real innovation. That must be developed by joint ventures between *different* disciplines, which means bundling complementary scientific knowledge: the future of science.

Finally, two cycles were shown in the innovation system presented: the knowledge cycle and the engineering cycle. However, this is not the complete picture (Berkhout, 2000). The system contains a third cycle on the right hand side: the market cycle (figure 3). In this cycle new products are introduced to the market to fulfil various socioeconomic needs: *service provision*. Hence, in the CIM industrial products are not considered on their own but are seen as 'building blocks' for the realization of new socioeconomic services. The market cycle becomes more and more important in the total process of innovation since the service sector increasingly steers the engineering cycle (feedback loop in the market cycle). In this paper

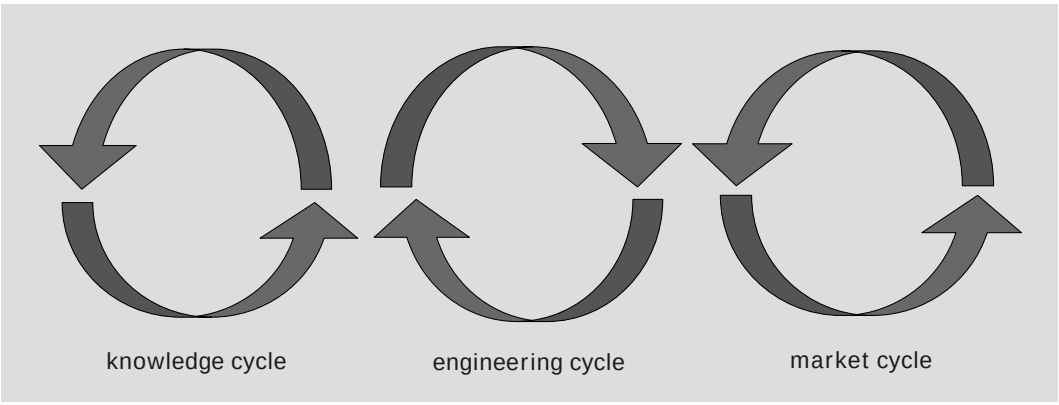

Figure 3: The complete innovation system consists of three coupled cycles. At a lower level of abstraction, each cycle can be represented by a multidimensional interaction matrix. Each cycle has its own dynamics and its own cycle time (Berkhout 2000).

the knowledge cycle is of primary interest and, therefore, the influence of the market cycle will not be further discussed.

The dissemination and integration of knowledge

In the innovation model presented, the various kinds of knowledge from science - from technological research and from product development - have been addressed at two levels of abstraction (figure 2 is one level lower than figure 1). All this knowledge contributes, via the interaction matrixes, to innovation. It is important to emphasize once more that technology[5] plays an essential role in the entire process as it fulfils a *bridge function.* This means that direct interaction between scientific research and product development causes figure 2 to degenerate into an innovation system with only one interaction matrix (science-product matrix). This is one bridge too far, not only because of the large difference in culture between left and right, but also because of the vital intermediate role of technology.

As already said earlier, the most critical processes take place at the crossroads of the interaction matrices as well as at the interfaces of the different cycles. Entirely new possibilities develop there by bringing together complementary knowledge and skills. But this also causes severe problems because successful interaction is determined by a complex social process where the capability to *communicate* plays a decisive role. This point will be returned to later in this paper.

The processes in the knowledge cycle of the CIM point out that in addition to the necessity of scientific depth, scientific breadth also has to become an indispensable component in university education and research. Much has already been said about the desirabilities and possibilities of a broad education. To elucidate the discussion it is useful to return to figure 2 and to differentiate between two different types of breadth: 'breadth with reference to the number of applications' and 'breadth with reference to the number of disciplines'. This is further illustrated in figure 4.

Scientific breadth of the first type deals with the application of knowledge within one single discipline to many different technological problems (figure 4a). Thus, here the breadth does not lie in the knowledge itself but in its use. Scientific breadth of the second type deals with the application of knowledge from many different disciplines to a single technological problem (figure 4b). Thus, here the breadth does not lie in the problem but in the knowledge. The importance of this differentiation is especially illustrated by the fact that people concerned are very different. Breadth of the first type is about knowledge workers who have learnt 'lateral thinking' and, thanks to their specialized knowledge, can make essential contributions to the solving of a large number of different technological problems (one-to-many). Breadth of the second type deals with knowledge workers who have learnt 'system thinking' and are able to achieve a large measure of coherence and synergy among the different disciplinary projects of a multidisciplinary research programme (many-to-one).

When universities talk about breadth then they mostly mean the first type. When industry talks

5. The term 'technology' is used here in the broad sense; thus not only beta, but also alpha and gamma technology. This is also true for the term 'product'; thus not only hardware, but also firmware and software.

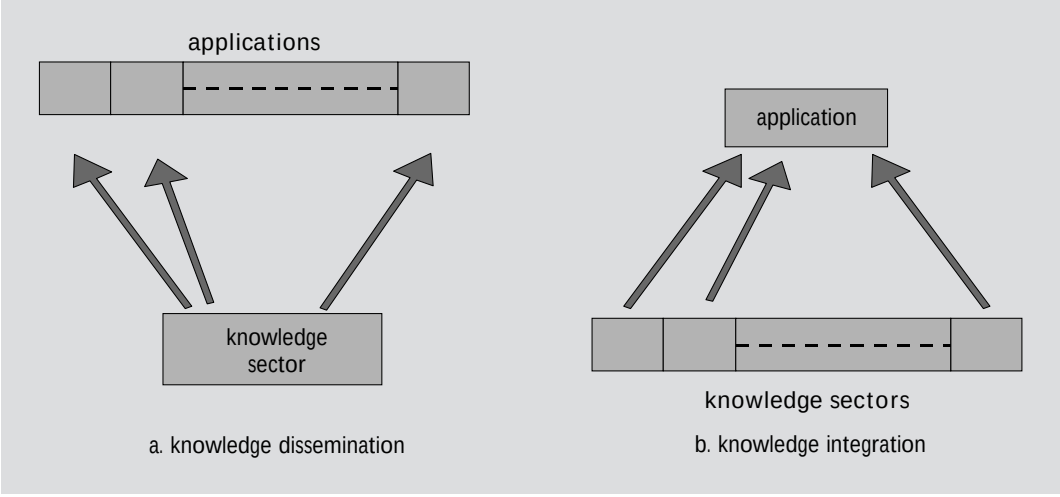

Figure 4: The two different types of width relating to knowledge dissemination (one knowledge sector contributes to progress in many applications) and to knowledge integration (many knowledge sectors contribute to progress in one application).

about breadth, it is usually type 2 that is implied. A good functioning between the supply of and demand for knowledge requires *both* types of knowledge workers. This creates additional conditions for academic education, both organizationally and in terms of content.

From the above it follows that major shifts in disciplinary research can be initiated in two different ways. Figure 4a indicates that new research impulses can be created in disciplinary research by shifting the area of application. By looking at new research goals, the existing scientific models may be exposed to new demands, or new possibilities may be created by introducing existing solutions to a new application. A current example is the shift in research from nonliving to living matter. Figure 4b indicates that new research impulses can also be created in disciplinary research by close cooperation with other disciplines. As was already discussed, interdisciplinary research may create new scientific insight into the *interaction* between the different processes in complex systems and it may enable a breakthrough in the development of new solutions. Current examples are a better understanding of microprocesses in biological systems (know why) and improved control of macroprocesses in ecological systems (know how).

The decomposition issue

Above, the coherence between the various specialist knowledge components was underlined with respect to research and to education. The necessity for scientific coherence is reflected by the forward integration process within the knowledge cycle of the CIM (left part of figure 2).

However, the feedback loop in the knowledge cycle indicates that at the same time another important aspect comes to the fore: multidisciplinary technological problems have to be translated into specific research projects for individual scientific specializations: *decomposition*. It is the author's experience that the process of decomposition represents a serious bottleneck in the formulation of multidisciplinary research programmes. At Delft University multidisciplinary research applications require clear answers to the questions 'what', 'why' and 'how'. The issues 'what' and 'why' are generally very well covered, but most applicants struggle with the issue of 'how', that is they find it difficult to give a clear description of the scientific approach in the multidisciplinary programme. The result is often merely a collection of independent disciplinary ambitions of participants who were tempted by the availability of funds. Therefore, when setting up multidisciplinary research programmes for technological problems, the decomposition process is of vital importance and the question to be asked is not: 'who wants to participate' but 'who do we need'. Through this the classic, positivistic forward way of acting is complemented with the postmodern, relativistic backward approach (inversion). This means for many faculties a not insubstantial culture shift.

It is interesting to note with respect to the above that, if the inversion approach is well executed, participation in multidisciplinary research programmes does not conflict with publication in disciplinary journals. The author knows from many years of experience that high-quality multidisciplinary research, organized in a suitable matrix network (see next section), does indeed lead to excellent disciplinary publications.

When setting up multidisciplinary research programmes, the focus should be particularly on the decomposition process. A consequence of this inversion approach is that the open invitation 'who would like to join' need be replaced by the specific question 'whom do we need'.

A new institutional concept

The cyclic innovation model implies that the university will have to be designed much more as a flexible *network organization*. The basic form of this organization is predetermined by the science-technology matrix: a network organization with vertical and horizontal processes (figure 2).
The basic organization of the university should therefore consist of rows and columns.
The columns are the traditional faculties, which again are subdivided into specialist departments (sub-columns). In the rows the specialized knowledge of the faculties is bundled into coherent, system-oriented research programmes. Thus, the knowledge basis in the rows is multidisciplinary and the disciplinary partial results have to fit seamlessly. This automatically leads to interdisciplinary activities. Regarding this university 'decompartmentalization' process, it is essential that individual scientific contributions remain specialist in character to guarantee research profundity. Thus, we are not talking about a choice (mono *or* multi), but about an enlargement (mono *and* multi).

To facilitate the interdisciplinary processes in multidisciplinary knowledge generation, the classical university organisation should be reconfigured into a network with a matrix structure. According to the mission of universities, the columns of this matrix will have to remain the carrying construction of the entire university building. After all, the rows can only function successfully thanks to the presence of strong columns. This means that the university matrix organisation is anisotropic in all regards: strong specialist columns with flexible multidisciplinary rows.

In the new institutional model the faculties not only provide the specialist knowledge for the system-oriented research, but also the elementary building blocks for *system-oriented education*. The plea is therefore that in a university study, the often many different education elements in an annual programme (one education row in the education matrix) have to be of high quality (depth) and demonstrate large coherence (width): no loose elements, but a solid structure! The knowledge cycle (left part of figure 2) transparently reflects this double task setting for university training. Professors who have problems with this important development are still spending too much time looking into their rear-view mirrors and do not see the rapidly changing environment around them and in which their graduates will have to work. Universities which bear this insufficiently in mind will attract fewer and fewer students. In the past, the traditional beta (natural and technical) sciences paid too little attention to the decompartmentalization of the many kinds of specialist knowledge (Dits and Berkhout, 2000). This could possibly be one of the most important reasons why the current generation of pre-university students in many countries judge these studies less favourably.

By way of conclusion, one of the biggest challenges in academia in the years to come will be to enlarge the coherence between the often many different segments of knowledge in both education (knowledge-lecturing) and research (knowledge-creating). This requires a system-oriented approach, facilitated by a flexible organizational structure with vertical and horizontal processes: the university of the 21st century.

A university education programme in which only loose pieces of knowledge are lectured, and which leaves it to the students to put these pieces together, passes over an aspect of academic education with ever increasing importance: learning to discover and use coherence. To discover and use coherence is not only necessary in order to be able to work in a system-oriented manner, but also to be able to absorb ('learn to learn') new knowledge in education and later on the shop floor fast and effectively.

Communication at different levels

It is demonstrated above that *profundity* is achieved in multidisciplinary high-quality research programmes through high-quality specialist knowledge in the participating disciplinary groups. The research results of these groups can be seen as pieces of a complicated jigsaw puzzle which have to match with each other in order to form the complete picture (system approach). This important statement is not only valid for the knowledge cycle[6], but applies to all CIM cycles.

Coherence in multidisciplinary programmes can only be achieved by a synergetic interaction between the various participating disciplines. This requires the capability to think conceptually as well as to communicate at *different levels* of abstraction. After all, it makes no sense to try conveying highly specialist details of your field to others who are not thus specialized. The more remote the disciplines are from each other, the higher the level of abstraction required to exchange meaningful knowledge and information. Thus, interaction between alpha (humanities), beta (natural and technical life sciences) and gamma (social sciences) knowledge workers will have to take place exclusively at the highest conceptual level, whereas specialists in the same field can communicate productively with each other down to the smallest detail (often using a jargon all of their own).

Universities will have to teach students already early in their studies to 'think in conceptual models' and to equip them with the capability to 'communicate at different abstraction levels'.

Academics are increasingly expected to work in an analysing and integrating way. In this context, costs and safety (anthropogenic component) together with environment and sustainability (ecological component) have become ever more important boundary conditions. This means that the requirements with respect to the communication capabilities of academics are higher than ever before.

6. It equally applies for the forward integration processes within the engineering cycle (pieces of the puzzle are individual technologies) and within the market cycle (pieces of the puzzle are individual products).

Introducing synergy between the flows of funds

It is disappointing that money talk plays such an important role in university circles[7]. There is a recurring discussion in the Netherlands about the role of the third flow of funds in scientific research. Opponents fear a further decrease in fundamental research. Their expectation is that this money will be used more and more for short-term assignments with 'fast results'. Supporters emphasize that the third flow of funds will actually strengthen the financial basis of the university and make badly needed investments in research resources possible. These are resources which can often no longer be financed by ever-shrinking government contributions.

It is interesting to note at this point that there is, however, a remarkable agreement between the supporters and the opponents. Both are of the opinion that the choice of one of the flows of funds implies the rejection of the other. This creates opposites which do not exist in reality. By making use of the cyclic innovation model this can be elucidated easily with the help of a concrete example.

Taking its own strength ('Delft core competence') as the point of departure, Delft University recently chose a number of technology themes ('Delft profile'), which may be expected to play an important socioeconomic role in the future. Furthermore it decided to formulate and execute a number of ambitious multidisciplinary programmes within these themes ('Delft portfolio') by reserving part of its first flow of funds revenues for this purpose. Following international assessment, around ten of these 'row programmes' kicked off in 1997. Now, an interesting phenomenon is occurring in that the participating fundamental research in the columns is attracting an increasing proportion of the second flow of funds. This is especially due to the strategic character of this fundamental research, but there is more to it than that. In recent years many companies have reduced their scientific activities. They are outsourcing this type of research, preferably to universities, and focusing themselves on technology, in order to strengthen their technology portfolios for their business units. Row programmes seem to have a strong appeal to the business community because they bundle the activities of many different specialisms (coherence) and visibly aim at ambitious technological objectives (focus). At the same time the director of a row programme negotiates with the business community from a strong position ('matching funds').

In conclusion, the three different flows of funds are complementary and are an excellent supplement for each other. The first flow enables new programmes to be started ('seed money' for the knowledge cycle), the second flow allows the fundamental components to be specifically strengthened (scientific profundity) and the third flow emphasizes the strategic aspects of research (the socioeconomic feedback loop). The different flows of funds for financing scientific research should not be placed opposite each other, but rather be used to achieve synergy between scientific ambitions and socioeconomic objectives.

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Professorial policy

The author's experience with the execution of cross-disciplinary research in row organizations indicates that a great need has developed for a second type of professor. Next to scientific experts in the specialized subcolumns, the university also has to attract professors who are both 'translators' and 'integrators' in the multidisciplinary rows. This new generation of professors consists of scientists who, in addition to their specialized knowledge, are able to convert a technical and/or social and/or economic problem into a research programme with a large number of different disciplinary projects (decomposition), and who can also achieve a large measure of coherence and synergy among these projects (fusion). The results should meet the expectations of the stakeholders of all three flows of funds, meaning that the output will obtain a high score for both 'scientific impact' and 'societal added value'. Using these points of departure, the university will be able to strengthen its inspiring and independent, critical role in broad layers of our society.

University-plus

Over the years it has been said many times: the development of new companies is of great importance for innovation and the promotion of employment. A very good example is the United States, where entrepreneurship is held in high

7. Basically, there are three flows of funds to universities in the Netherlands: (1) from the government, (2) from the national research council and (3) from industry.

esteem. There, the development of high-quality activities around national universities is of great economic significance, while much innovation takes place in the small companies set up as a result.

Up to now, Dutch universities have mainly produced graduates who become *employees*. Enterpreneurship (thus making money) with knowledge was long not considered a worthy option for a graduate. Fortunately, this is changing. Most of our universities now have arrangements of some kind to support graduates in setting up their own companies. This is an interesting development. After all, until now, much too little money has been available for the high-risk phase, in which the commercial value of the new concept has to be demonstrated with a prototype ('seed money' for the engineering and market cycle). In future, universities should concentrate much more on supplying young knowledge-intensive *entrepreneurs*. In particular, they should provide 'seed money', not only for the knowledge cycle but also for the other cycles. This initiative should become part of a broad university strategy for intellectual property.

Universities, technology institutes and industry

In the cyclic model of the innovation system the feed-forward and feedback processes play a central role in each cycle. We saw above that a closer look at the processes in the *knowledge cycle* shows that technological research is asking for the integration of many scientific disciplines, and that, at the same time, this integration has a steering influence on the activities in disciplinary research. In addition, a closer look at the processes in the *engineering cycle* shows that product development demands an integration of the many technologies and that this integration also has a steering influence on the activities in the technological research. Thus, technology institutes have to acquire status in *both* cycles: in the knowledge cycle as 'integrators' of scientific knowledge and in the engineering cycle as 'translators' of ambitious product specifications into technological building blocks (dual task). The consequence of this is that the activities of technology institutes may by no means be characterized as the second step in a linear knowledge system!

Finally let us dwell upon the differences in the missions of universities, technology institutes and industry from the innovation system presented (figure 2). We see that the universities are primarily active in the knowledge cycle, and in this case the columns have to be dominant to ensure 'scientific depth'. We also see that the technology institutes are active in the knowledge cycle as well as in the engineering cycle, and this time the rows have to play a dominant role to ensure 'cross-cyclic communication'. Finally we see that the traditional industry is primarily active in the engineering cycle and hereby the columns have to be dominant again to ensure market value[8].

The above leads to the general recommendation that an effective approach for strengthening the knowledge infrastructure would have to take place on the basis of the steering and integrating functioning of the *rows* in the knowledge and engineering cycle.

8. Note that major changes occur in the market cycle. Industrial products increasingly become the principal building blocks of new socioeconomic services (Berkhout 2000).

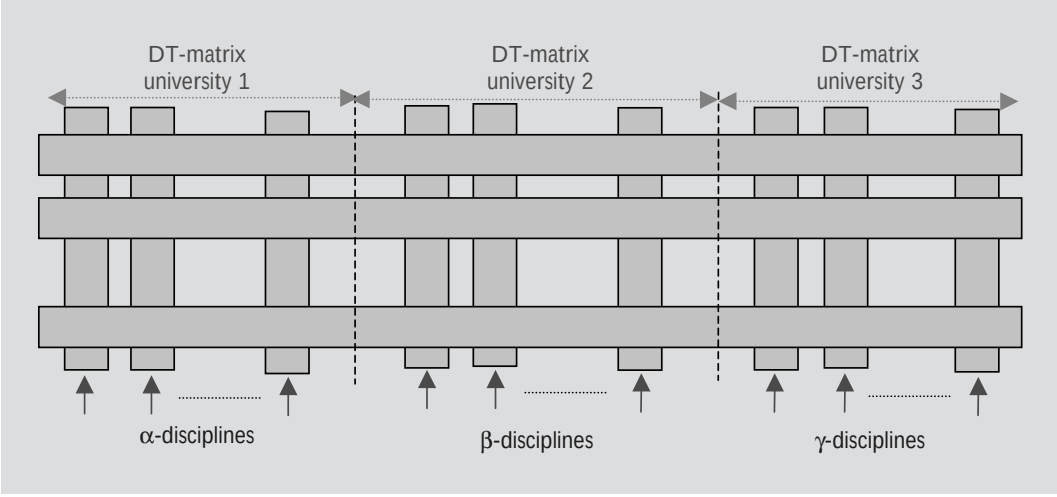

Figure 5: Future university collaborations will have to focus mainly on multi-disciplinary programmes which combine the top specialist knowledge of different universities. Here collaborations (the rows) are shown between one university with strong alpha (humanities) disciplines, one university with strong beta (natural and technical life sciences) disciplines and one university with strong gamma (social sciences) disciplines (the columns). Weak disciplines do not participate.

Concretely, this signifies for the universities the large-scale stimulation of system-oriented education and research programmes with disciplinary profundity. It also means that universities would have to choose a different point of departure for cooperation. Cooperation within one discipline is certainly useful but is no longer sufficient. In future, innovation will just have to be achieved through joint ventures between the *different* disciplines. That is where the great opportunities lie: the future of science. Figure 5 shows how multidisciplinary cooperation between three complementary universities could be established.

Universities jointly dispose of a very broad portfolio of excellent scientific disciplines. The added value of this breadth can be increased in a spectacular way if more coherence is applied among cross-university disciplines.

Conclusions and recommendations

1. *The cyclic innovation model as a framework for communication*
   The insight into complex systems (technological innovation, economic growth, labour market, environmental quality, health care, societal security etc.) can be increased substantially if the communication among stakeholders is effected on the basis of a 'framework'. In an earlier dialogue (Berkhout, 1997) the CIM was presented as an attractive framework to facilitate the major discussions in our society.

   Assisted by the CIM, the future of the university has been presented in this paper. A general conclusion is that a strongly *discipline-oriented* university is not considered capable of complying with the high societal expectations in the years to come.

2. *The creation of coherence*
   In the years to come one of the biggest challenges for the university will be to increase coherence between the, often numerous, different segments of knowledge in both education (knowledge-teaching) and research (knowledge-creation): this requires a far-reaching 'decompartmentalization' of the (sub)faculties.

   The discovery and utilization of coherence are not only requisite to be able to work in a system-oriented manner but also to be able to absorb new knowledge in education, and later on the shop floor, fast and effectively ('learn to learn').

3. *Combining differences*
   In the past, scientific cooperation was mainly stimulated within the *same* disciplines. This is certainly useful, but not ambitious enough. In future, innovation will have to be achieved through joint ventures between the *different* disciplines: 'toppling the cooperation'. In this context the classic forward way of acting ('who wants to participate') has to be complemented by the postmodern rearward approach ('whom do we need').

4. *Strong columns and flexible rows*
   The great need for multidisciplinary cooperation indicates that the classical university organization is no longer satisfactory and will have to be adapted to form a network organization with vertical and horizontal processes. Therefore it is suggested that the basic university structure consist of rows and columns. The columns are the traditional (sub)faculties. In the rows the specialized knowledge of the (sub)faculties is bundled into multidisciplinary research programmes. These programme-oriented rows have to develop into the new interuniversity link.

5. *Not polishing, but shifting frontiers*
   Innovation is the motor of our society. The unique mission of universities is to function as dynamic centres where critical, independent scientists develop new concepts which may have an important influence on science and society. Therefore, universities have to remain far from routine contract research.

   The great force of an innovative university training is that academics learn to critically hold existing procedures against the light and are motivated to search for new solutions. These academics are widely employable, independent of their discipline.

6. *Functioning in a team*
   Universities should not aim at preparing students at a high pace for their first job. Academic education should aim rather at a sustainable career in society. In this context, the ability to work in multidisciplinary teams plays an increasingly important role (see also

recommendation 2). Cooperation in multidisciplinary teams requires communication at *different* levels of abstraction. The teaching of this skill has to form the focus within the academic education. This requires a not insubstantial adaptation of the academic curriculum.

7. *Synergy between the flows of funds*
The discussion about the roles of the first, second and third flow of research funds suggests contradistinctions which do not exist in reality. The three different flows are complementary and can therefore supplement each other very well. The first flow (government money) enables universities to start up new multidisciplinary programmes ('seed money' for the knowledge cycle). The second flow (science foundation money) allows the fundamental components in these programmes to be strengthened (investments in scientific profundity). The third flow (industry money) emphasizes the strategic aspects (concretization of the socioeconomic feedback in the knowledge cycle).

8. *The mission of the technology institutes*
Technology institutes have to acquire status in both technology-related cycles of the CIM: in the knowledge cycle as 'integrators' of specialist scientific knowledge and in the engineering cycle as 'translators' of ambitious product specifications into technological building blocks (dual task). The consequence of this is that the activities of technology institutes may by no means be characterized as the second step in a linear innovation system. The necessity to integrate technology in product development in a broad manner (engineering cycle) requires far-reaching cooperation among the different institutes.

With regard to the innovation policy of governments, the different cycles within the innovation system (knowledge cycle, engineering cycle, market cycle) have to be distinguished.

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Literature

- Barnes, B. and D. Edge, *Science in Context: Readings in the Society of Science,* Open University Press, Milton Keynes, 1982
- Berkhout, A.J., 'Science and Business: Increasing the impact of the science base on product(ion) innovation', invited contribution to the future science and technology policy of the OECD, 1997
- Berkhout, A.J., *The Dynamic Role of Knowledge in Innovation*, Delft University Press, 2000.
- David, P.A., 'From market magic to calypso science policy: A review of Terence Kealey's *The Economic Laws of Scientific Research*', *Research Policy*, 26, 1997, pp. 229-55
- Dits, H.P. and A. J. Berkhout, 'Towards a policy framework for the use of knowledge in innovation systems', *Journal of Technology Transfer*, vol. 24, no. 2/3, 2000
- Kealey, T., *The Economic Laws of Scientific Research*, MacMillan Press, London, 1996
- Netherlands Academy of Engineering, *Towards a better utilization of knowledge and industry,* 1994

Agricultural research: in ivory towers or in farmers' fields?

Stein Bie

In 1996 FAO estimated that there were 840 million people suffering from food insecurity. The data actually referred to estimates for about 1990/91, the last figures that were available. The FAO-IFPRI estimates this figure at 750 million for the year 2000. In spite of significant population growth in the last decade, the number of food insecure has therefore been reduced by 90 million, or about 6 times the total population of the Netherlands. That is no mean achievement, but it went largely unrecognized by the media. It was achieved by the continuing fall in food prices, an increase in purchasing power for some of the poor, and by farmers across the world who ultimately provide the food. It was also helped by a series of reasonable growing seasons in the 1990s throughout the world, in spite of everything that is being said about global climate change. Some food insecure countries, such as India, have actually had sequences of very good seasons.

The bad news is that about 50 times the population of the Netherlands remains food insecure, has a low standard of well-being, and will die prematurely due to poor nutrition, and that we will lose relatively more women and children through food insecurity than able-bodied men. It is also bad news that the media do not find it interesting to inform their viewers and readers about this situation. That is the picture and basically, it is a promising one. What we have done together - you through your development efforts by investing Dutch taxpayers' money in rural and urban development, and we as agricultural scientists by focusing on food security - has produced handsome dividends. The continuing ugly side of the picture is the gross injustice of a world that is easily capable of feeding a much larger global population than we currently have, while three-quarters of a billion people suffer food insecurity. Together with Denmark and Switzerland, the Netherlands is among the European countries that deserve praise for resolutely focusing attention on the food producing sector at times when many countries have primarily been looking for lucrative possibilities for their manufacturing industries in developing countries. Those of you who supported agriculture can take comfort from the good news with which I started.

What role does agricultural research play in the changes in food security and purchasing power that we have witnessed in Asia and in Latin-America, and which we would all dearly like to see in Africa, too?

Let us for a moment look back at our own history of economic development. Essentially, all rich countries have been able to grow rich on the back of significant productivity gains in agriculture, that allowed farmers to feed many industrial workers and people in the service industries. In most industrialized countries this came about through massive central government investment in centralized research establishments, conducting research in their own laboratories and their own experimental fields. The harvest of research results was brought to the farmer through a government-financed extension system. It worked. In the Netherlands, in France, in Germany and in many other European countries. A centralized model, ivory tower but backed by a good and heavily subsidized extension system. In the industrialized world there were two strong exceptions to this model. In the United States, the Land Grant Universities had much closer relationships with farmers and did much of the research in close association with them, including in their fields. And in the Nordic countries, a significant proportion of agricultural research was organized by the farmers themselves, in their own fields, with them employing the scientists, albeit subsidized by the government. Both models worked well, as have the commodity-based commodity boards (for tea, coffee, cotton, sisal, etc) of the colonial powers, all conducting research in close association with the growers (although these were normally less than desperately poor). Some of the newly independent countries took these boards over, and some still work.

The model, however, on which we based the Green Revolution, was a very centralized model, like the classic European model, with ivory tower research in CGIAR centres like IRRI and CIMMYT, but with strong government-backed extension and infrastructure services. Not without its faults - some social, some environmental - the Green Revolution has nevertheless contributed greatly to food security in Asia and - to a lesser extent - in Latin America. So why not in Africa? The heterogeneous farming landscape of Africa is more difficult to master than the lowlands of Asia, and the educational level of the population was initially lower. But the major reason is probably that the steps from the ivory research towers to the African farmers were never built. They did not receive the investment given to Asia and Latin-America because of Africa's lesser geopolitical role during the Cold War. So the research centres, international as well as national, did not really address real

farmers' problems, only perceived them. The relative lack of progress in improving food security in Africa is in many ways a function of the inability of the research community to ensure its relevance and the dissemination of its research.

That is the bad news. The good news is that there is a great and largely unexploited potential for increased production of food in Africa. Much relevant research is also on the shelf, but needs to be complemented with research that addresses real farmer problems. The typical African farmer is no longer a 40-year-old male farmer, but a 13-year-old girl trying to keep a family together that has been torn apart by AIDS and other diseases, and social and military unrest. Most agricultural research has failed to notice this change. It is time now for it to do so.

Secondly, we must use the knowledge that we gained from our own development, namely that poor farmers can only become wealthy and take responsibility for their own future if we are willing to subsidize both research and extension over the long period that it takes for them to build up enough purchasing power to become paying knowledge clients. I am worried that liberalization and privatization will exclude a large proportion of poor farmers from research and extension. The idea that farmers should buy knowledge on the private market may be fine, but if you have nothing to spend, you get nothing. Someone has to take responsibility for the poor, and in my view it should be the development community. Universities cannot be expected to generate and disseminate agricultural research information to the poor out of the goodness of their own hearts. And I am concerned that financial interests will tempt them away from tropical poverty problems to tropical prosperity problems.

My conclusion is quite positive: there is a lot of mileage left in agricultural research, even without resorting to genetically modified organisms, which I see as a huge red herring in the ongoing debate on poverty eradication. It will be a long, long time before GM organisms can provide food security in the tropics. It must come through sound, close-to-the-farmer research in a favourable economic and infrastructural setting.

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Discussion

After the lecture, Mr Rob van den Berg, Director of the Policy and Operations Evaluation Department at the Dutch Ministry of Foreign Affairs, acted as discussant. He drew a parallel with the shift in development policy to the effectiveness of development aid and the focus on good policy and good governance. He stated that African governments have in the past often pursued bad agricultural policies, and that institutes like IFPRI and ISNAR have worked on bridging the gap between agricultural research and government policies. He underlined the importance of market failure in Africa, which has to be countered by development cooperation. He pointed out that Wageningen Agricultural University seems to be moving away from poverty-related problems. The priority of Dutch policy as regards the CGIAR is to stimulate problem-driven research through its Ecoregional Programmes. Examination of the experience of these programmes will reveal whether this approach has been fruitful. As to research and knowledge, Mr Van den Berg pointed out that intellectual ownership is on the move, as WTO discussions show. CGIAR and ISNAR still focus on research as a public good, yet the borders between public and private knowledge are shifting.

During the discussion with the floor, the question was posed whether the structure of the CGIAR is still relevant. Founded in the 1950s, IRRI and CYMMIT provided the technical push to the Green Revolution. Later on agronomics were incorporated, followed by the social sciences, and a focus on farming systems. In the 1980s, the research agenda broadened again, to incorporate the area of natural resources. The most recent approach, the Ecoregional Programmes, takes account of individual farmers and the environment in an aggregated way. But have institutional arrangements changed sufficiently to accommodate these changes? How can small farmers influence the research agenda? Does ISNAR have experience with interactive approaches, relating researchers with users of research like farmers and policy-makers? Dr Bie noted that the structure is indeed under fire. National research institutes are often part of the colonial heritage in which clients have no influence. In some countries, however, new structures are evolving in which customers do have a say. ISNAR was asked to help in developing a client-oriented research agenda. Customers' interests can be incorporated into new institute Boards. Some members of the audience questioned whether CGIAR institutes could ever accommodate such mechanisms for influencing research agendas; influencing through Boards was felt to be ineffective. A critical question was posed about the extent to which international agricultural research has contributed

to the decline in food insecurity. Has research had anything to do with it, or should the decline be attributed to the efforts of small farmers? And the other way around: will more agricultural research lead to an amelioration of the livelihoods of small farmers or are other factors more important? The final subject of discussion was the issue of agricultural research as a public or a private good. Mr Bie noted that 50 % of all funding for agricultural research comes from private companies (the 'Monsantos'). Of all agricultural research done in Africa, 9.8 % is conducted by the CGIAR. Mr Van den Berg added that identifying problems together with stakeholders is very important. Only a small part of research is currently for the public good. He argued that, besides problem-driven research, there is still a need for technical laboratory research, for example on malaria.

rawoo

Seminar proceedings

Opening

Gert van Maanen, chairman of RAWOO

This seminar is in honour of Professor George Waardenburg, the founding father of RAWOO. In German they call such a person the *Urheber*, 'the man who invented us'. The mere fact that RAWOO exists is to a large extent the direct result of George Waardenburg's lasting commitment. He more or less started RAWOO in 1979. Now RAWOO has grown up and become mature.

It is with great satisfaction that we see how many people showed interest in this seminar. In fact, not all those who wanted to participate were able to do so, because of the limited space of this venue. When you are very closely involved in a certain topic, you are inclined to believe that you are alone. The fact that so many people have come is a boost for everybody who is concerned about utilization of research. For all those people who hope that the results of their efforts are getting beyond the bookshelves in libraries.

The first time I personally experienced the need for utilization of research was at DGIS. George Waardenburg had organized a meeting where people who had written their PhD theses on a development-related subject were invited to tell their story. What struck me was their deep commitment to the issue that had kept them busy for years and their visible joy that there was finally a platform where they could share their findings with Dutch policy-makers. For me, as an 'outsider', it was remarkable that it had taken so many years to bring these two groups together. The joy of the participants was understandable. No researcher likes the results of his or her work to be put on a shelf or in a catalogue and forgotten. You are not only carrying out research - and this is especially true for development studies - to boost science or to add your name to an honours list. You are doing it above all because you want to make a difference. You want to have some impact on decisions that affect people in the South.

Well, in your seminar material you found a marvellous exposé by Jack Spaapen, who conducted a recent literature study on utilization. For me, at least, it was an eye-opener that the subject had many more dimensions than a person from what we call in Dutch the 'maatschappelijk middenveld' (civil society) would imagine. Spaapen distinguishes three categories: policy-makers, other researchers and users. But within the RAWOO framework, these are not three categories but six, because we focus on these three groups not only in the Netherlands, but also - and foremost - in the South. We focus on them, but not because they are our target group. I don't think that any Dutch person would like it if a group of Americans were to come here, tap us on the shoulder and tell us we were their target group. That kind of language makes you the object instead of the subject of the research, the 'investigatee' rather than the investigator. We know from American research on euthanasia in the Netherlands what strange conclusions you can reach if you don't have your antennas deep into the society you are investigating. So, one of RAWOO's major *raisons d'être* is to find a fair balance between researchers and other stakeholders in the South and researchers in the North. The aim is to get relevant issues, as perceived by the South, higher on the international research agenda than they are at present. That is difficult enough. It is not free of dilemmas. Sometimes you have to put on your brakes. For most Dutch people it takes a great deal of mental energy *not* to speak too soon and *not* to climb into the umpire's chair at the first sign of a dispute in the South.

If we are serious that research on development has the ultimate objective of making a difference to the daily life of people in the South, it would be a waste of time and energy if we did not place utilization very high on our agenda. True, there are a lot of dilemmas, and pros and cons. But these deserve to be debated and addressed. No one expects the right answers to be found this afternoon, but it would be a great step forward if the right questions were asked. That is why this meeting was organized.

mr Gert van Maanen is General Manager of Oikocredit (Ecumenical Development Cooperative Society) in Amersfoort, the Netherlands, and Chairman of RAWOO.

Rethinking utilization

Georg Frerks

In 1998 and 1999 RAWOO organized a series of lectures and debates on the utilization of research for development. The background was a concern about the apparently limited use of research outcomes in development policy and practice. RAWOO wanted to explore why this was the case, why academics and policy-makers addressed different questions and why research was often presented in such a way as to make it practically useless for those involved in practice. It was also intended to offer suggestions for solutions by looking into the institutional conditions that needed improvement, by taking initiatives to bridge the gap between researchers and policy-makers.

Participants in the seminar all received the contributions to the debate by both scholars and users, and also what the authors modestly called 'a quick scan of recent literature' on utilization of research in North and South. While rethinking utilization I would like to focus on three fundamental issues. First, how can the problem be defined and understood? Second, what demonstrable ways of solving the problem can be identified? Third, what actions need to be taken by the ministry?

Before starting to answer these questions, a few preliminary remarks need to be made. As observed by Spaapen and Wamelink utilization itself is an elusive concept.[1] They refer here to the development and use of new knowledge for socioeconomic and technical innovation. Utilization is no longer seen as a simple linear process. In contrast, it is a very dynamic, iterative interactive process between stakeholders who may operate in changing roles of producer, intermediary and user of knowledge. Moreover, as they indicate, the difference between 'research for policy' and 'research for society' may also have important implications. The first area requires from the government a focus on internal knowledge management, while in the second area its role of intermediary is at stake. To complicate things further, research itself may also vary enormously. It may, for example, be fundamental or applied, it may concern 'knowledge for understanding' or 'knowledge for action'[2], may support or criticize policy, and may be mono-, multi- or transdisciplinary, theoretical or technological. Moreover, as observed by Spaapen and Wamelink, the product of research, knowledge itself, also gets transformed in the process and may assume a different meaning through social processes at work at the interface between knowledge production and utilization. This may even be more so when this interface comprises a different cultural setting, as shown by different studies in the tradition of Wageningen sociology.

Utilization also has to do with the broader issue of societal relevance and the question of whose needs and interests are to be addressed. In terms of development research in the Netherlands, this has meant a shift in focus to the development of user-oriented programmes to which RAWOO has made important contributions. It would, however, be naive to suppose that this significant change of policy is sufficient to address all questions and dilemmas surrounding utilization. What are these and how can they be approached? This brings me to my first two questions.

How can the problem of research utilization be understood and solved?

A first observation I would like to make here is that a clear-cut analysis of this issue is lacking, also in the presentations of the lecture series. Spaapen and Wamelink mention that utilization rarely appears as a separate subject for descriptive study and that there are hardly any studies of the more reflective kind.[3] In this connection, it seems to me that even the World Bank report discussed during the series had little to say about the deeper complexities surrounding utilization.[4] Is the problem then so self-evident? I don't believe so. Moreover, I think that the problem needs to be distinguished between 'research for policy' and 'research for society' and within the latter perhaps between the social and more technologically focused sciences. The very interesting contribution by Frans van den Beemt[5] leads me to conclude that the process of technology development, with a prominent role for industry and commercial considerations, differs considerably from that found in development studies, though some general features - like networks and user committees - may have a more general relevance. Yet, in the different lectures we find some indications on the nature of our questions. Let us first focus on 'research for policy'.

In the very first lecture of the RAWOO series, Professor Waardenburg recalled Carol Weiss' notions of 'knowledge creep' and 'decision' or 'policy accretion'. On the one hand this means - and I quote from Weiss' work here - that 'research knowledge affects the development and modification of policy in diffuse ways. It provides a background of empirical generalizations and ideas

1. Spaapen, J. and F. Wamelink (2000) 'Utilization of research in North and South, a quick scan of recent literature' (draft working paper), The Hague: RAWOO, p.3-4. [note from the editor: a later version of this paper has been included in this publication as an annex]

2. See: Scott, R.A. and A.R. Shore (1979) *Why sociology does not apply; a study of the use of sociology in public policy,* New York: Elsevier North Holland Inc.

3. Spaapen, Jack and Frank Wamelink (2000), *idem*, p. 4.

4. The World Bank Report 'Knowledge for Development', lecture by Lyn Squire, see pp. 38-40 above.

5. Beemt, Frans van den, 'The use of academic research for technological development', pp. 18-26 above.

that creep into policy deliberations'. Regarding policy itself she has the following to say: 'Many policy actions are not decided in brisk and clear-cut style …. Without conscious deliberation, the policy accretes'.[6] This basically implies that the role of knowledge is very indirect and difficult to trace, while the process of policy formulation itself is also rather intangible. In his contribution, Waardenburg declared these notions valid for the Dutch Ministry of Foreign Affairs, saying: 'The kinds of situations described here scarcely need any amplification with examples, as they are familiar to us all. Who, from this ministry, can remember ever seeing a specific research finding that was available as a ready-made, take-it-or-leave-it option during policy planning?'

Waardenburg further mentioned the seven different models of research utilization identified by Weiss that in his opinion all contained 'realistic elements without any one appearing to have a monopoly on the truth'. He concluded that the ministry should better define the areas and problems for research and foster more direct ties with researchers. He also mentions the relevance of enabling conditions at the level of the ministry itself.[7]

In his contribution, Arie Rip points to the problem of communication and the requisite communication infrastructure. There is a need for cognitive translation from abstract knowledge to application in a specific situation. Rip rejects a linear model of knowledge production in favour of a more interactive model. In this connection, he emphasizes the importance of strategic research positioned somewhere between fundamental and applied research. Strategic research will produce a broad base of knowledge likely to form the background to the solution of recognized current or future practical problems, he says. The knowledge produced will be available in knowledge reservoirs from where users can 'fish' or 'grab' what they need. Potential users require access to such reservoirs and need to acquire the competence to fish there. The classic user-orientation will only linearize the model and may, therefore, be deficient or at least insufficient. I may add here that developments in the field of ICT further problematize the issue.[8]

Professor Berkhout, in his contribution, also denounces the traditional linear model and introduces a cyclic innovation model integrating scientific and technological knowledge as well as service provision. Communication and bridging are key issues here. On the other hand, multidisciplinary technological problems have to be decomposed into individual scientific specialization by a process of 'inversion' requiring new institutional solutions of a network and matrix kind. The personnel needed for this type of institution are 'translators' and 'integrators', capable of decomposition as well as fusion, creating coherence and synergy.[9]

In his paper, Sengupta[10] elaborates on the roles of policy-maker, researcher and political authority and distinguishes between the technical viability and political acceptability of solutions that are to be formulated on the basis of the understanding of the problem. The researcher should help the policy-maker by identifying alternative profiles of possible solutions and their trade-offs and methods of implementation. It must be finally possible to sell these policies to the political authorities and other stakeholders. The example of policy reform in India shows how difficult this aspect of 'saleability' may be in practice. Sengupta argues that further development of scenario studies and the modelling of projections may be a useful tool in this connection. Whereas Sengupta believes that this element of political acceptability in fact increases the usefulness of studies and enhances the role of the researcher, other observers take an opposite position.

Discussing evaluation research, Lekanne asserts for example that the lack of application of findings is caused by the theoretical underpinnings of much research and its social and policy context. Evaluation, like other research, presupposes a rational, scientific planning model, which has never been adopted in daily development practice, or - he adds - in Dutch development cooperation. He states that in a plural, complex and disorderly society decisions on goals and programmes are political compromises that do not necessarily correspond with the outcomes of research.[11] In this game between scientific rationality and political opportunism the exigencies of the political environment finally determine the use, non-use or abuse of research findings. Even if one were to disagree with this analysis, there is enormous pressure within the ministry to pay attention to the issues-of-the-day and it is obviously difficult to focus on more long-term and fundamental questions. This reinforces a vicious circle of increasingly reactive responses, if not outright ad-hocism, to the detriment of pro-active analysis and preventive action.

6. Weiss, C.H. (1980), 'Knowledge creep and decision accretion' in *Knowledge, Diffusion, Utilization,* Vol. 1, no. 3, pp. 381-404.

7. Waardenburg, George, 'The utilization of research results at the Ministry of Foreign Affairs: points of departure', pp. 9-12 above.

8. Rip, Arie, 'Utilization of research: a sociology of knowledge perspective', pp. 13-17 above.

9. Berkhout, A.J., 'The university of the 21st century, multidisciplinary science in a flexible network organization', pp. 53-62 above.

10. Sengupta, Arjun, 'The utilization of research results: the case of policy reform in India', pp. 41-44 above.

11. Lekanne dit Deprez, B. (1995), 'Evaluation as contested knowledge' in Frerks, G.E. and J.H.B. den Ouden (eds) *In search of the middle ground: essays on the sociology of planned development.* Wageningen: Wageningen Agricultural University.

Regarding the use of 'research for society', references in the material were limited to some models and examples of case studies. I have already referred to the models for technological research introduced by Van den Beemt. Bunders gave an interesting overview of research approaches for resource-poor farmers.[12] She indicated the limitations of linear 'Transfer of Technologies (TOT) models', of the more advanced 'triple helix model' and the participatory models, and introduced the 'Interactive Learning and Action (ILA) approach'. The ILA approach has a number of prominent features, such as the central role of the farmers, trust relationships, mutual learning and coalition building, knowledge integration and a process of intermediation. A case study on Bangladesh proves that the complexity involved rules out easy successes and that no generalizations can be made due to local specificity. Yet, action research, experimentation and comparative work may inform practice at the local level to be used by those that rarely benefit from general science and technology programmes.

Another case study presented by Patel shows how poor people have benefited from a bottom-up research on urban pavement and slum dwellers in Mumbai.[13] Finally Bie gave examples of successful agricultural extension and the challenges ahead in providing food security to the world's poor.[14]

What then can we conclude now regarding our first two questions? The answer is that the lack of research utilization for policy can be attributed to a number of quite different factors, including:

- The variegated nature of research itself;
- The elusive concept of research utilization;
- The unspecified and unobtrusive way knowledge is being used in policy ('knowledge creep' and Weiss' seven models of research utilization);
- The intangible process of policy formulation ('policy accretion');
- The tension between scientific rationality and political opportunism;
- The pressure of actuality and the lack of time to focus on long-term issues;
- The lack of sufficient interaction and two-way communication;
- The lack of capacity to formulate policy questions in research terms and research findings in policy terms and solutions;
- The lack of favourable conditions and - perhaps less so - of institutional mechanisms;
- The use of outdated linear models of research utilization.

Lessons learned include the following items:

- More emphasis on strategic research, cyclic innovation models and scenario studies providing alternative solutions;
- More emphasis on networking, communication and the building of accessible knowledge reservoirs;
- Integration of different kinds of knowledge;
- The mobilization of new capabilities in terms of communication, building of relationships, synergy and coherence, 'translation' and 'integration'.

As far as 'research for society' goes a number of the more fundamental issues, as well as some of the lessons learned, are the same as those mentioned above. In addition the following lessons may be derived from the presentations given:

- There is a strong need to build from local experiences and specific locations;
- Generalized models have serious limitations and work has to be field-based or at least field-tested;
- It is difficult to derive generalized approaches, findings or lessons learned;
- The participation of users and prospective beneficiaries is absolutely desirable but may linearize more complicated interactive models.

Finally, I would like to address my last question: what action needs to be taken by the ministry?

Action to be taken by the ministry

None of the seminar papers explicitly addressed this question. Yet I belief that they contain a number of implicit themes that merit mention. I also am tempted to add a few suggestions of my own. First of all, there is a lingering doubt in many people's minds, in academia and within the ministry itself, about whether research still enjoys the same importance as in the past. This is, of course, an institutional issue, but also refers to the interest and attitude of the higher and even highest authorities. It needs no further clarification that support at these levels determines to a significant degree the activities and behaviour of the ministry at large. It is regrettable to mention that several researchers and academics told me that they have been approached by the ministry with disinterest, and sometimes even with arrogance and condescension that are difficult to understand, let alone accept. This, of course, can and should be

12. Bunders, Joske, 'Utilization of technological research for resource-poor farmers: the need for an interactive innovation process', pp. 27-37 above.

13. Patel, Sheela, 'How can poor people benefit from research results?', pp. 45-50 above.

14. Bie, Stein, 'Agricultural research: in ivory towers or in farmers' fields?', pp. 63-65 above.

changed. Despite the necessary user-orientation in the overall research programming and the focus on local needs in the developing world, one must not forget that there is a lot of expertise in the Netherlands itself that may be mobilized and can be put to use. What is needed here is a process of mutual communication and exchange. We have learned that this will not happen automatically and that it requires a structure. We also have learned from the 'dissertation days' that it may require a heavy input.

Another lesson was that such events would require focus and need to be related to specific issues and interested audiences. A new initiative being implemented at the moment, the 'BeWe Afternoon Sessions', seems to be developing in this direction. Leen Boer describes these seminars in more detail.

I have also mentioned a number of more specific themes as emerging from the papers, including the types of models, approaches and studies required and the type of attitudes and capacities to be developed. A theme that was not discussed but is also highly pertinent is that of developments in the ICT sector.

I would like to conclude by wishing that RAWOO's lecture series and this seminar will lead to a more systematic reflection and practice on the use of research. The speed of changes in the world, including many parts of the developing world, demands continuous study, from both from the academic and policy perspective, to inform practical ways of solving the problems that the poor face in so many parts of the world.

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Utilization of research in Tanzania

Joseph Semboja

There is no single strategy for promoting the utilization of research between countries. This is because countries differ in many aspects. For instance, some have strong states, others have a large donor influence, and others have a strong civil society. Differences in the power relations among the various stakeholders in a country will determine the channels through which research can influence policy. I will focus on Tanzania to illustrate this point.

One of the major problems of Tanzania is the lack of resources. In spite of this weakness, fairly generous donor support has enabled the government to acquire a near monopoly in, amongst others, service provision and policy-making. Until recently, civil society has been very weak or almost non-existent and has played its role within boundaries determined by the government.

For a poor country like Tanzania policy is about poverty. Therefore, influence on policy is influence on poverty reduction initiatives. And for the poor, it is their immediate needs that matter: access to basic essentials like food, shelter, clean air, health service, water, etc. But for policy-makers, the medium and long-term concerns are equally important: the need to build capacity for sustainable poverty reduction. Therefore, an effective research programme has to influence policy on the allocation of resources both to satisfy the immediate needs of the poor and to strengthen capacity in the longer run.

How should this happen? How can research influence policy-making for short, medium and long-term needs? Within the context of a resource-weak government, a strong financier (donor) and a weak civil society, how can this be realized? Our experience in REPOA shows that research programmes have to do more than undertake societally relevant research to influence policy. In other words, although societal relevance is a necessary requirement for policy relevance it does not guarantee that the research results will automatically be incorporated into policy. Research programmes have to understand the power relations among the various stakeholders in order to influence the process of policy-making. This is a learning process that all individual research programmes have to go through. We would like to use the experience of REPOA to illustrate the point.

During its first two years the REPOA programme focused on undertaking research and building the capacity of young researchers. The policy linkage was developed through three main channels. The first was through the incorporation of non-researchers in the research and capacity building processes. This group also included policy-makers. The justification for including non-researchers in research and capacity building activities was to facilitate the use of research results in policy-making. The second was through the institutional structure of REPOA. The Steering Committee of the REPOA programme had membership from the government, such as the Ministry of Finance, the Planning Commission and the Vice President's Office, the Ministry responsible for poverty issues, the NGO community and the private sector. The third channel was research workshops which attracted the general public, including policy-makers.

By the beginning of the third year, it was clear that the policy linkage was still very weak; the REPOA programme was hardly known in policy-making circles. Our research findings were not adequately reflected in the policies, in spite of the many useful research projects that had been completed and presented in many workshops. It became clear at this point that a different strategy for linking with policy had to be developed.

One thing was becoming clearer - that two distinct groups existed:

- the research group, organized around REPOA. It included researchers and non-researchers from the government and to a limited extent the private sector and civil society;
- the policy-making group, organized around the donor community (financier), through the government. It included the government and to a limited extent the private sector and civil society. The research linkage for this group mainly came from consultants from Europe and America. Policy-making was increasingly becoming dependent on short-term consultancy studies.

The two groups had to be merged for our research results to benefit policy. The REPOA programme decided to take the initiative to merge the two groups by establishing a window that would encourage collaboration among the relevant policy-making stakeholders. In other words, REPOA had to declare its interest in joining the policy-making group. Therefore, in addition to the research undertaking that involved non-researchers, workshops that brought together the general public and policy-makers and the institutional

arrangement that included policy-makers, the following actions were taken:

- REPOA became a member of the policy-making group. A few examples that show our participation in policy-making will suffice. We participated in the drafting of the Tanzania Vision 2025, the Poverty Reduction Strategy Paper (PRSP) and the Tanzania Assistance Strategy (TAS). We also participate in the yearly consultative government budget process undertaken through the public expenditure review (PER) process. In all these instances results from our research are used.
- We have introduced a training course for policy-makers. We are currently training local government planners and community development staff on how to mainstream poverty in development programmes.
- We invite all development partners in our workshops; our definition of development partners now includes the donor community. This is so that they can witness that good research can be done by local researchers and that there is no longer reason to invite consultants from abroad to do the work for policy.
- We are currently initiating formative research; a type of research that is undertaken parallel with implementation of a particular policy, for example, the ongoing Local Government Reform Programme (LGRP). This is a kind of outside or independent monitoring aimed at providing unbiased feedback to the programme.

In the context of the above, what opportunities and challenges do research programmes face? Firstly, care must be exercised to avoid being swallowed up into a department of the government or of the donor community. That would imply loss of objectivity. The REPOA programme has protected itself against this danger by establishing rules and regulations that guide collaboration with other stakeholders. Secondly, the independence of research programmes relies heavily on their financial autonomy. At the moment, funding from DGIS allows MMRPs to say 'no' if the conditions are not in accordance with their mission. MMRPs should be able to determine conditions for collaboration because they do not currently depend on any development partner for financial support. Thirdly, there is a long-term incentive for research programmes not to be swallowed by any of the collaborating partners. A large part of the credibility of research programmes is built around their independence from governments and donors. It forms the basis of their objectivity.

Two conclusions can be drawn from the above discussion.

Firstly, it is important that research programmes do not isolate themselves from local reality. In practice influencing policy means being part and parcel of policy-making. For some countries policy-making involves more than the local stakeholders, it may also involve donors. This means that no blueprint partnership arrangement can be made available to research programmes.

Secondly, it takes time for research programmes to influence policy. Therefore, we should not start worrying too early if research is not turned into policy immediately. It can take three or four years, or even longer, for this process to be completed and then the research results also have to be of good quality and societal relevant.

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Improving utilization of research through stakeholder involvement

Joost Ruitenberg

In my presentation I would like to link the issue of utilization of research to the process of designing a collaborative (South-North) research programme, in this case the Ghanaian-Dutch Programme of Health Research for Development. This programme was developed under the auspices of the RAWOO in close cooperation with the Health Research Unit (HRU) of the Ministry of Health in Ghana. Over the past few years, I have been involved in the setting up of this programme, as a member of RAWOO and of the programme's steering committee. The thrust of what I will be presenting is that the use of knowledge in health policy and health care delivery can be enhanced by involving stakeholders in the health sector in the process of agenda-setting for health research. Stakeholders in health research include the following: policy-makers, health programme managers, researchers, public and private health care providers, and communities. The underlying assumption is that drawing stakeholders into this process increases the chances that the research will respond to their needs, and that the outcome will be relevant for development purposes.

Three key questions guided the preparations for the development of the joint Ghanaian-Dutch research programme:

- what is knowledge for health development?
- how to design a policy and an organizational framework for a collaborative programme;
- how to build consensus among policy-makers, researchers and the user community in Ghana, and researchers in the Netherlands?

The big challenge here is how to make a bridge between the South and the North if you start your programme from the South. Over the years, RAWOO has developed a number of policy principles with regard to research in the South. One is that the steering of research should be done through a demand-driven approach involving the relevant stakeholders. Another is that a comprehensive approach needs to be developed, aimed at integrating the support for collaborative innovative research and the support for building and strengthening the national capacity for research. In our view not just research programmes or projects need to be developed, there should always be a link with capacity building. Another RAWOO policy principle is research on an equal footing. These are quite mysterious words: what do we mean by them? For us, they mean that Southern researchers participate as equal partners in the design and implementation of the programme. They must have an equal say in the policy and decision-making process. Moreover - and even more important for long-term sustainability - they should have an equal say in the governmental and management structure.

Experience with the stakeholder model

How were these policy principles applied in the Ghanaian-Dutch Programme of Health Research for Development? The basic question was how to draw up a research agenda which responds to the needs of the health sector in Ghana. For us it meant starting with the voices we heard, with what the various stakeholders brought in as their needs and concerns. And, in order to arrive at an equal and genuine South-North partnership, Southern ownership was strongly emphasized during the process.

The programme was, of course, not developed overnight, nor by RAWOO alone. The Health Research Council of the Netherlands (RGO) and the Netherlands Organization for Scientific Research (NWO) were also involved. We first had to select a pilot country with which we could jointly develop and put into practice the approach outlined. We decided to opt for Ghana, because it has a long tradition in medical research. Moreover, Ghana has a wide-ranging focus, emphasizing the broader concept of health determinants already when Primary Health Care became a major policy goal. It focuses not only on the absence of disease, but also on factors that influence well-being. And there is experience with health system research, including research at the district level.

As I indicated, we felt it was important to listen to all stakeholders. It proved that policy-makers were already well aware of the fact that research could provide answers to some questions. They were aware of the need for reforms in health delivery to be supported by research. And there was already some experience in working together with the research community. Another important element was that the Ghanaian Ministry of Health had already formulated a Medium-Term Health Strategy (MTHS), which addresses a number of well recognized health issues:

- immunization through EPI (WHO's Expanded Programme on Immunization);
- a reproductive health programme;
- the prevention and control of infections with epidemic potential (like cholera);

- health protection and promotion (for instance in sexually transmitted diseases);
- the prevention and control of nutrient deficiencies;
- the management of selected endemic diseases (like leprosy and TB).

Careful consultation process

The next question was how to start a demand-driven process of agenda-setting for health research. That was a key issue in discussions with our Ghanaian counterparts. In my opinion, the last two years offer a rewarding and wonderful experience. From the very start of the discussions it became clear that research is essential for problem-solving in health care. We realized the importance of the link with the MTHS: this could secure long-term sustainability.

The process of agenda-setting involving all key stakeholders proved to be an interesting experience. But how do you synthesize their ideas? How do you involve the researchers, not primarily on the bases of their own interest, but as participants in demand-driven research? Furthermore, the question of ownership and long-term sustainability was tackled. We agreed there should be a steering mechanism representing various stakeholders within a Joint (Ghanaian-Dutch) Programme Committee (JPC).

During the preparatory phase we had consultative meetings in 1998 and 1999 bringing together the three main stakeholder groups: the research community and academia, policy-makers and service providers, and the end-users represented by community-based groups and non-governmental organizations (NGOs). Together with these groups we organized a number of more in-depth consultations and appraisals of problems, needs and concerns. We asked the researchers and academic research institutions what they were doing, what their needs were, and what were their hopes and dreams. Health programme managers and health practitioners at district level were asked how they perceived the problems as providers of health care services. Thirdly, we conducted consultations with the community. Community constraints were assessed in all of Ghana's ten regions using participatory rapid appraisal methodology. The outcome of the discussions with these three groups were written down in three separate documents:

- what did the researchers want to do?
- what were the real needs of the health care providers?
- what was the community interested in?

A few months ago, in March 2000, we started to synthesize these ideas. All the inputs were put into a matrix which was based on the five cross-cutting health system issues identified in the MTHS:

- access to health service (distance, gender issue);
- quality of the health service;
- efficiency (integration of programmes);
- linkages with other sectors (private practitioners, public institutions, traditional healers);
- financing.

Translation into a research agenda

Finally, in April 2000 we sat together in Accra with thirty representatives of the three groups of stakeholders, and researchers from the Netherlands. We asked them to help us translate the needs and constraints identified into research questions and to draw up the research agenda. The research topics were prioritized with the help of the following criteria:

- strategic relevance for the national health framework;
- relevance for the community;
- contribution to the improvement in health status/health care provision;
- utility for the solution of problems;
- urgency of problems

We have now practically completed the document for a five-year research programme in support of the Medium-Term Health Strategy for Ghana (2001-2005). In my view, the major programme components - knowledge development, capacity enhancement and the dissemination of research results - indeed support the long-term health policy of the Ghanaian government. Not from a narrow point of view, however, but from the stakeholders' perspective. The research priorities of the programme have now been grouped around four critical issues:

1. communication and community participation;
2. quality;
3. financing;
4. decentralization.

These four issues have been translated into research questions. To give some examples:

1. Communication and community participation. This deals, among others, with gender issues. In the case of health care for communicable diseases, for example, how is the TB programme to be translated in order to be

perceived by the children of the village? The same applies for HIV/Aids and malaria.

2. Quality. A very practical example is that many infectious diseases, like malaria, TB and HIV/Aids, are treated only with 'first-line' drugs. Ghana lacks the resources for 'second' or 'third-line' drugs. This means that there should be a high compliance from patients, but even more so by the provider. Under the umbrella of research into anti-microbial resistance, answers should be sought to a number of questions, like:
   - is this HIV-strain resistant to the drug, and if so, why?
   - is the healthcare person delivering the service? Are there any guidelines?
   - how is the compliance of the patients?
3. Financing. How can we target services to vulnerable groups? Some intervention studies are designed to tackle this important issue.
4. Decentralization. Originally, health care was characterized by vertical programmes, dominated by the government. Then decentralization programmes started. It is, however, difficult to see whether these programmes have effect. What are, for instance, the constraints at district level to the implementation of a TB-control programme?

The programme is now ready. We have identified the innovative research which is needed. The programme identifies the needs for capacity building and addresses the issue of the dissemination of results. Moreover, it also contains mechanisms to involve the various stakeholders in the South and the research community in the Netherlands.

Doable

What conclusions can be drawn? I think that this programme, in the two years of the preparatory phase, has already shown that stakeholder involvement is not only essential, but also doable. That was the big question when we started. Is it doable to formulate research questions relevant to the stakeholders in health research? I think it is. But it still has to be proven that the research results are going to be used to improve local health services and the heath status of the Ghanaian population. The proof of the pudding will be in the eating. We hear from our Ghanaian counterparts that they promote this approach with other donors because they have already learnt its value. Finally, I hope that the Ghanaian experience with multi-stakeholder participation in planning and conducting health research will also stimulate the discussion on new ways of knowledge production in the North. We ourselves, as we are here, might still learn a lot.

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Utilization of research in Dutch development cooperation

Leen Boer

Research, especially academic research, is not a very 'sexy' topic within DGIS. In that sense DGIS is a rather normal governmental bureaucracy. Many officials in such bureaucracies - at all levels - are not particularly enthusiastic consumers of research results. If they do have to use research results, they tend to prefer the 'fast food' equivalent: easy to get and easy to digest. And, I guess, some would add the word 'cheap' as well. The prevailing image is a preference for research that underpins existing or planned policies. The question remains, of course, whether these images really reflect reality, and to what degree.

Whether these images are right or not, the problematic nature of the relationship between research and policy, between researchers and policy-makers has been long recognized. The paper by Spaapen and Wamelink shows us that there has been a continuous effort to reconceptualize the problems in that relationship.[1]

Yet, the explanations of the problematical relationship between researchers and policy-makers are familiar too.[2] Most refer to the different functions policy-makers and researchers perform in society. Policy-makers and administrators are interested in the realization of certain goals, in the formulation and implementation of a policy. In that they tend to seek guidance in the past, 'basing action on what has won assent, or on what they believe, on the basis of previous experience, will win consent'[3]. Routinization and incrementalism are inherent in bureaucracy. They are coupled with a tendency to conservatism.

Researchers, on the other hand, have a stake in presenting new data or even new images of reality. It is new insights that give prestige in the world of science. Other familiar explanations could be added, such as the continuous tension between generalization and specification, the different time perspectives of policy and science (the 'pressures of the day' confronting policy-makers, referred to by Georg Frerks) and differences in jargon[4].

In the series of lectures leading to this seminar, the linear model of research utilization was adequately denounced as irrelevant. Utilization of research does not reflect a classical extension model, in which policy-makers and administrators are passive users of scientific truths delivered to them by researchers. On the contrary, research or science is only one of several competing sources of information. Ministers and political parties, interest groups and the press, and policy-makers themselves produce information and knowledge. It is sometimes forgotten that there is pluralism in the supply of information that is useful - or has to be used - for policy-making. As my namesake, Joan Boer, the Deputy Director-General for International Cooperation - who, much to his regret, could not attend today's seminar - tends to say, what we need in policy-making is 'informed opinion'. So, researchers do not have an exclusive right to provide information. And let us not forget science itself: it, too, is a source of competing streams of information and knowledge. Utilization, moreover, is a layered or plural concept. There are different kinds of users. Policy-makers, administrators or Spaapen's professional users are also most of the time intermediaries between researchers and user-publics or end-users[5].

In all these respects DGIS is no different from any other governmental bureaucracy. However, in the case of development cooperation, there are additional complications as far as utilization of research is concerned. There are more user-publics and most of them are far removed from The Hague. DGIS policy-makers and administrators have numerous counterparts in the countries we cooperate with. And, last but not least, researchers are involved from the South as well as from the North, as Gert van Maanen pointed out in his introduction to this seminar. Between all those stakeholders all kinds of interactions occur.

In the past twenty years - in other words, in the period since the RAWOO was installed and during which it evolved - there has been a growing recognition that the total picture is far from simple. It becomes even more complicated if we realize that not only the interests of the different stakeholders tend to diverge, but also their power or leverage. Relations between them, in other words, are not symmetrical. There are - sometimes considerable - differences in power. Of course, the final picture is very country or location-specific, as Joseph Semboja rightly emphasized.

To summarize, current wisdom is that the production, consumption and application of knowledge, including science and technology, has an increasingly complex and systemic character. More actors and stakeholders than ever are considered to have a role in this system. Different kinds of user-publics have been included. Actors combine roles; they often produce as well as utilize knowledge. Complex patterns of interaction occur,

1. Spaapen, Jack and Frank Wamelink, Utilization of research in North and South: a review of recent literature. See the annex of this publication.

2. Boer, L., and L. Box (1994), 'The tenuous interface: Policymakers, researchers and user-publics: The case of the Netherlands' development cooperation', Knowledge and Policy 6-3/4: p.159.

3. Dery, D. (1990), *Data and policy change. The fragility of data in the policy context, xii,* Boston: Kluwer Academic Publishers.

4. Boer, L. and L. Box (1994), *idem,* p.159.

5. Boer, L. and L. Box (1994) *idem,* p.160; Spaapen, Jack and Frank Wamelink, *idem.*

or - as we should probably still say in many cases - should occur in order to make the system function well. Involving users is considered essential to enable research to be focused on the relevant questions and issues and to ensure it is relevant and usable.

Utilization within DGIS

Now I would like to focus first on utilization of research within DGIS and then on the problem of utilization of research funded by DGIS in developing countries.

Research utilization within organizations such as DGIS nowadays tends to be seen within the broader context of knowledge management. The intellectual quality of an organization such as a foreign affairs ministry and its openness to outside knowledge and views require continuous maintenance. Georg Frerks already referred to that need. It was one of George Waardenburg's tasks to bring policy and research together. He did so, for example, by organizing major seminars in which the policy relevance of a large number of PhD theses was discussed by the authors and policy-makers. But George has now left us and we are gathered here today to honour him.

Still, the maintenance I just mentioned is required; now more than ever that has to be a collective responsibility of all those working at DGIS. A task force has been formed recently to draw up an inventory of means and instruments that can be used to reinvigorate the knowledge-base of DGIS and to keep it from becoming an inward-looking organization. Members of this task force will be visiting several universities in the Netherlands in the coming months, with the intention of starting a dialogue. They will ask for views from outside. What do academics and researchers think of the current DGIS? Do they themselves see a need for more dialogue? If so, what form should that dialogue take?

At the same time the task force will be considering the pros and cons of a number of activities and issues, including:

- sabbatical periods for DGIS officials;
- membership of DGIS officials of boards of academic and other institutions;
- twinning arrangements between DGIS departments and academic or other knowledge institutions;
- a more systematic policy with regard to trainees;
- internal publication series;
- restoring the balance in the Ministry's internal training programme by adding - once again - courses on substance (currently most courses in the training programme are focused on processes).

Of course, seminars such as those organized by George Waardenburg will continue.
Earlier this year, the Ministry's Strategic Policy Planning Unit and Research and Communication Division started a series of seminars bringing researchers and policy-makers together. These seminars, which are ad hoc and custom-made, are known as 'BeWe Sessions'. 'BeWe' is an acronym for 'Beleids-Wetenschap' (Policy-Science). Every now and then other DGIS departments organize similar lectures or seminars, and they should continue to do so. Of course, the annual RAWOO lecture series will be continued as well.

Policy research is instrumental in DGIS's knowledge management. Many departments are funding such research. Crucial for policy relevance is that the research has to be based on internal demand. The interested divisions or departments within DGIS should be more actively involved in the dialogue on research questions and methods as well as on the ways in which results will be fed back into the policy and implementation process.

Utilization in developing countries

I would like to conclude with the topic of utilization of DGIS-funded research within developing countries.

Since 1992 - the year in which the policy document 'Research and Development' was published - the DGIS research programme has increasingly been focusing on building and utilizing capacity within developing countries. In doing so it has been the intention to ensure the relevance of the research for the society in and for which it is being carried out.

Capacity has to be built from within, however, not from the outside. There is a major difference between building capacity from the outside and from within, i.e. on the basis of ownership and a demand-driven approach. The research agenda must be based on demand. Local stakeholders have to set the research agenda, and local researchers should conduct the research. Utilization of research has to be part and parcel of research design. These issues go together, in a systemic sense: ownership, local capacity, demand-orientation and a built-in focus on utilization.

To summarize, it is and has been the goal of the DGIS research programme to stimulate developing countries in using and - if and where necessary - developing their own independent and indigenous research capacity. A capacity focused on providing solutions to local problems. A capacity capable of capturing local opportunities for sustainable development. A capacity for research, in other words, that is both relevant and excellent.

In the eight years that have passed since the new policy was announced, multi-annual, multi-disciplinary research programmes (MMRPs) have been established by local institutions and steering committees in nine countries (Bangladesh, Bolivia, Egypt, India (the state of Kerala), Mali, Nicaragua, Tanzania, Uganda and Vietnam). Local ownership and management, and stakeholder and user involvement are the major principles applied to ensure the social relevance of research.

Research is also funded on a thematic basis, focused, for example, on agriculture or, within agriculture, on biotechnology. Often, that is done as one of several donors on a regional or even worldwide basis. The Consultative Group on International Agricultural Research is the most prominent example. In these collaborative efforts, too, we press for a more explicit focus on impact and utilization and on their preconditions: ownership, demand-orientation and capacity-building in developing countries.

Several programmes are focused on South-North cooperation. Prominent among them are the RAWOO programmes on health in Ghana - I refer to the presentation by Joost Ruitenberg this afternoon - and on biodiversity in the Philippines. In these programmes the research agenda is based on demand in the countries concerned and the focus is on research and capacity building in these countries. Cooperation with researchers from the North takes place within that context.

The Research and Communication Division is preparing a report on lessons learned in the past eight years, since the publication of the policy document on 'Research and Development'. Our experience shows that it is possible to establish an independent, relevant and sometimes also high-tech, cutting-edge research capacity in developing countries. Just now, Joseph Semboja presented the case of REPOA in Tanzania. There are other examples, in biotechnology for instance, such as marker-assisted breeding capacity in Kenya and Zimbabwe.

In order to achieve relevant and indigenous research capacity in developing countries, local ownership and relative autonomy are essential. I say 'relative autonomy'; the research programme is part of Dutch development cooperation. So its goal is also to reduce poverty through development. But, within broad conditions of support, local priorities and local choices should make research capacity truly owned and relevant.

It will not surprise you that it takes time to realize true ownership. That lesson appears to be self-evident, but is often forgotten. Traditional and conditioned reflexes, on the part not only of the donor but also of the recipient, have to be unlearned. That takes time and effort. Mutual trust and patience are essential. Broad representation of stakeholders in steering committees furthers trust and ownership. Investments in ownership pay off[6]. That is also a lesson we have learned.

The articulation of demand takes a lot of time as well. 'Whose demand?', the question Joseph Semboja referred to just now, remains a difficult question to answer. In the early nineties this issue tended to be called the Ganuza-dilemma[7]. It appears to be rather difficult for researchers to actively communicate with end-users or people that represent them. It appears even more difficult for them to integrate the wishes or needs of users in research questions and to use the information acquired in the dialogue during the research process itself. At this level too, relationships tend to be a-symmetrical.

Furthering utilization is a matter that requires continuous attention. It is very easy and tempting to publish research results and then go on to the next research project. A dialogue on the results, dissemination workshops and other more labour-intensive efforts to disseminate results to user-publics tend to require much more effort. They should be planned for from the beginning. Dissemination is an intrinsic part of research activity, and should not be considered separate, or an add-on.

6. Lange, P. de (1999), 'Inhoudelijke autonomie leidt tot commitment in onderzoek door ontwikkelingslanden', Tijdschrift voor Wetenschap, Technologie en Samenleving 7-3: 94-99.

7. Ganuza, E. (1990), 'International cooperation: A Latin American perspective' in C. Schweigman and U.T. Bosma (eds.), Research and development cooperation. The role of the Netherlands, Amsterdam: Royal Tropical Institute, pp. 16-24; Berg, R. van den (1991), 'Lessen voor het onderzoek beleid van het DGIS' in L. Boer (ed.), Onderzoek en beleid in de Nederlandse ontwikkelings-samenwerking, The Hague: Ministry of Foreign Affairs, pp. 33-46; Pronk, J.P. (1990), 'Development research never can be neutral: A conference review' in C. Schweigman and U.T. Bosma (eds.) idem, pp. 168-173.

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Plenary Discussion[1]

1. Report prepared by Peter Conrad.

After the break the audience participated in a plenary discussion. The panel consisted of the four speakers, the chairman and Mr Waardenburg, special guest of the seminar. The six experts responded to questions and remarks from the 120 experts on the other side of the table. Below is a summary of the most important issues discussed.

Chairman:
mr G.H.O. van Maanen (Chairman of RAWOO)

Panel:
drs L. Boer (Ministry of Foreign Affairs and advisor to RAWOO)
Prof. G.E. Frerks (Ministry of Foreign Affairs)
Prof. E.J. Ruitenberg (RAWOO)
Prof. J.J. Semboja (RAWOO)
Prof. J.G. Waardenburg (ex-Ministry of Foreign Affairs and ex-advisor to RAWOO)

Contribution of research to policy-making

The discussion first centred on research findings which have finally been translated into policy. The panel was asked to give some examples.

Mr Semboja: 'My institute has been asked several times by the government of Tanzania to write major policy papers and strategies. To give you an idea: in the last two years REPOA has participated in the formulation of the following policy-making initiatives:

- National Poverty Eradication Strategy (which is under preparation);
- Tanzanian Social Action Fund (which is now being implemented);
- Small Enterprises Loan Facility (which is also now being implemented);
- Tanzanian Assistance Strategy.

It is difficult to say and to know exactly which results of which research projects found their way into which policy/strategy: it is an accumulation of projects which have been done over the last five years.'

Mr Waardenburg: 'In addition to suggesting solutions for practical problems, research may also provide new conceptualizations of reality (including the recognition of problems) and long-term perspectives, which may be quite important for policy-making and society in general.'

Ms S. Montaño, who works at ECLAC and is a member of RAWOO, remarked: 'I know from experience that there is no linear continuation from research to policy-making. As a matter of fact, there is a big difference between the two. In research you are looking for innovative answers. Policy-making has to be more conservative: you cannot change a policy just by knowing one fact or one aspect. You need generalized knowledge and you need to build on that. The impact of research on public policy is not that it gets translated into a law or in guidelines. Research helps to build arguments and even to eventually criticize policy-makers.'

Mr Van Maanen: 'People who change policy seldom do so because they read a particular book. There are many reasons to change policy. What is important is that policies are adapted in response to various forces: from politics, from civil society, from research, etc. It is less important who did the trick, than that the trick has been done.'

The importance of financial resources

Mr M. Brands (Homeopaths without Borders) remarked on the problem of financial resources: 'One of the big problems for researchers in the South is the lack of financial resources. In many developing countries there is no tax policy (or it exists only on paper). So we can talk about policy-making and about healthcare issues or whatever, but what are the inhibitions in societies in Africa? There is a lot of money around, but not in the government. Civil society is still weak. One of the consequences is that a lot of initiatives in terms of policy-making or research programmes still go through the government. In Ghana, for instance, there is no legislation on tax. That means that a lot of money is not being touched upon. There is no management structure to take care of this. Do you think research can contribute to identifying the inhibitions in society?'

Mr Semboja: 'The major problem of Tanzania is resource mobilization. Many Tanzanians are too poor to pay taxes. We are now initiating a research programme on taxation, because we think it is a crucial issue. It will be a comparative study between Uganda, Tanzania and Namibia. The idea is to look at the evolution of taxation in Tanzania and what we can learn from the past. In the 1960s, tax per person was higher than today. So, by comparing ourselves with other countries, we should be able to get an idea why they are better at collecting taxes. One of the problems with studies

like this, particularly studies of local authorities, is that these authorities are independent. So you have to look at countless local authorities, because they all have their own systems. And, at local level you have to influence so many authorities that it is in fact impossible.'

Mr Van Maanen: 'Behind this question is another one. If Tanzania were to pay for this themselves, they could set the rules and could do what they want. One of the major reasons they are not free to do that is because the bill is paid by others.'

Mr Semboja: 'Money is important: it provides power. The main reason why we in Tanzania decided to include other donors is not that they should decide on policy. Donors should be part of the partnership, because of transparency. Even if we had excluded one of the stakeholders, we would still have had to answer their questions at the end. So, you can better include them from the beginning. Also, you educate each other: they give you their views and you give yours, and in the end they give you the money.'

Mr Ruitenberg: 'In the research on health in Ghana in which I participated one of the difficulties we came across was the tax exemption policy. Poor people did not have to pay taxes, but they could go to the community health centre for free. In a sense that was OK, but what happened was that they were not referred from the community health centres to private medical practitioners. We realized that this was a very important constraint in targeting vulnerable groups towards the kind of care they needed. This question has been identified and will be addressed in the Ghanaian-Dutch programme.'

The role of the stakeholders

Mr H.A.J. Coppens (IDPAD programme) expressed his compliments on the elaborate preparation of the health research programme, but wondered what, in the end, was really new on the agenda, what could not have been known already without this thorough process. And, in relation related to this, he commented: 'Maybe the most important stakeholders in the research process are the users, i.e. the potential beneficiaries. What role do they play in the pre-implementation phase, in the agenda-setting of the research, and what is their involvement in other stages of the research?'

Mr Ruitenberg: 'In the Ghanaian research the stakeholders, including the community representatives, will be involved in implementing the research and they will monitor whether it is really tackling the problems which have been identified by them. They will be used as a kind of sounding board during the process. Each year there will be a stakeholders meeting, where the state of affairs will be presented. So, there will be a continuous monitoring of the process. As to the first remark, we learnt some interesting things from the discussions with the community. TB is a treatable disease: there are good drugs at the moment. When these drugs are available and the patient takes his or her medicines on a regular basis there is no problem. However, due to the co-infection of HIV and TB, one reinforcing the other, people nowadays hesitate before going to the local health centre to get treatment for TB, because they are afraid they might have HIV. This problem was identified by local people. So, one of the questions is: how could you get rid of the anxiety that if you go to the health centre the verdict is HIV and not TB, which is treatable? The potential research question is whether this attitude, i.e. postponing the visit to a health centre, is present at all levels in society, including among youngsters at school and the elderly. The research will try to get an idea of the sort of anxiety perceived at different ages in the community and what are the best communication messages to overcome it. Without this sort of discussion hardly anybody at policy level would have thought that this was an important issue.'

Mr Boer remarked that even if the substance of the agenda did not change, it is important to involve the users - whether they are end users, intermediate users or policy-makers.

Prof. Dr. J.W. Gunning (Vrije Universiteit Amsterdam) drew attention to the problematic nature of the phrase 'stakeholders': 'Everybody is talking about "identifying stakeholders", but no one knows exactly how to do it. There are many different types of stakeholders: each with their own interests and their own power. I have not heard power mentioned all day.' Mr Gunning gave some examples to illustrate that the success of a programme depends on the balances of power and asked the panel: 'Why do you use the term "stakeholder", which I find very uninformative, and not address the real problem?'

Mr Boer: 'I definitely used the word power. If I remember well at least twice: I used the terms symmetry and asymmetry and that is definitely a power problem. Of course the phrase "stakeholders" is problematic. I mentioned that the

"Ganuza dilemma" is still there. In my personal opinion: there will never be a perfect solution, because that would mean perfect democracy. The models that have been put on the table are very limited models of representation. We are trying to find out how to make research more relevant, and for me that is an integral part of the process of research that is being funded by DGIS.'

Mr Frerks: 'The question: what do we mean by stakeholders, can perhaps also be asked with regard to "gender", "participation", "bottom up", and so on. There are so many politically correct words that it makes me nervous. I start to wonder what is the content of all these notions and whether we exactly understand the words we use. A whole series of intervention studies related to development cooperation has shown that there is a gap between how policies are formulated and how they are implemented. And when things are implemented we see that it goes wrong - somewhere - despite all these beautiful words, structures, ideas and motivations. I am not doubting any of these ideas or policies in principle, but I think that after so many years of trying to implement them, the question arises: what is exactly the difference, how do these policies work and what type of results do they finally produce? To answer all these questions we will need critical intervention studies, related also to the Dutch Ministry's own research policy. In that respect I am very glad to hear that these types of critical studies are being carried out. I would really welcome more of such studies, hoping that the ideas that we all have in our minds can finally be realized.'

Mr Ruitenberg: 'We should not overemphasize the importance of the word "stakeholder": it is just a word we use to identify groups who have some interest in what we are doing. In Ghana we have identified the groups which we thought were relevant. "We" in this case are the Ghanaian counterparts involved in the problems in their country.'

Dr E.C. Kosters (ITC) wondered whether we in the Netherlands should not be a little more modest in trying to direct research and in trying to direct Southern countries in involving stakeholders and users. She remarked that 'We really do not know how to do it ourselves' and urged us to be realistic rather than be patronizing.

Mr Van Maanen: 'I remember a stakeholders meeting in Ghana. This meeting was put on the agenda by RAWOO, or, to be more precise, by the six overseas RAWOO members, of which three are women. They said: "There should be a hearing for district nurses". The Ghanaian Ministry of Health was not planning that at all. As a matter of fact, I am quite convinced that the civil servants at the Ministry found it rather patronizing. At the same time, however, I am quite convinced that the district nurses themselves did not find it patronizing at all. The basic warning is: don't do it on your own with the people who are paying. Be aware that, if it is society-driven research, you pay a price in terms of consultation. But, in the end, you will praise the day that you had that consultation.'

Freedom of research topics or dependency?

Another topic debated was whether the Dutch research world has become too dependent on DGIS. Dr S. Bie from ISNAR, who gave a lecture in the present series, suggested that research institutes which rely heavily on funding from public sources, like the Ministry of Foreign Affairs, have become opportunistic in relation to the signals they get from the ministry. 'That is the only way we get money for research. The cycle time of signals is getting shorter and shorter. For instance, in 1990 it was "gender", in 1992 in Rio it was "sustainable development", in 1996 at the Food Summit it moved on to "food security" and currently we are in a phase where "poverty eradication" is the keyword.' Mr Bie observed an imbalance here: much of the trend-setting in development research comes from DGIS and little from the universities, and asked the panel whether this is desirable: 'The question is whether you want development research in the Netherlands to be driven by a think tank outside the academic environment or whether you believe that the academic world should be more aggressive and come forward with its own ideas on what development research should be about?'

Mr Waardenburg: 'In my opinion Dutch researchers of development should decide themselves what issues they want to tackle. As researchers in a field with a highly human dimension they have their own responsibility. It would be strange for them to wait for a signal from the Ministry or a think tank. As far as I am aware, DGIS has no master plan for Dutch development research. It has an agreement with the Ministry of Education, Culture and Science that the latter is responsible for maintaining Dutch capacity for development research, while DGIS is

responsible for using this capacity. The maintenance of this capacity is in practice delegated to the universities and appears subject to some corrosion. The use of this capacity is maintained, however, and financed by DGIS as part of development cooperation policy, i.e. as much as possible in accordance with development priorities and research agendas from the developing countries themselves, and in equal collaboration with researchers there. On average only a small proportion of Dutch research has been affected. Priorities in areas like poverty, gender and environment remained unchanged during the nineties. Although research in the South and the North has contributed to the formulation of priorities, a more aggressive attitude from Northern researchers will not improve the process of priority-setting, but will just put their own interests upfront. For Northern researchers it is not easy to develop a "listening attitude" with respect to the South. Moreover, they have a lot of space for research outside DGIS funding.'

Mr Van Maanen: 'I am puzzled by the observation that there is a kind of "wait-and-see" attitude at Dutch universities. Looking back at these "dissertation days", there appears to be a production of one dissertation a week dealing with a "South-issue". Not bad, for such a small country! The research related to these dissertations was financed by all kinds of sponsors: universities, ministries and foundations. Compared to other countries the Netherlands has a much higher interest in development studies. I would not like the idea of somebody at DGIS deciding upon the kind of development studies researchers could carry out. These decisions should be in the hands of universities and foundations.'

Mr Boer: 'With regard to the issue of shortening policy cycles: part of it, of course, is reconceptualization. For the greater part of the last ten years I have been involved in policy planning and policy-making in the field of development cooperation and in my opinion part of it is just "old wine in new bottles". To an extent this may explain the gap between policy and practice. But I disagree completely with the observation that poverty reduction is a new issue in development cooperation. This would mean that after fifty years of development cooperation, we have only focused on poverty reduction in the last couple of years. This, of course, is not true.' Mr Boer shared the concerns expressed by the audience on Dutch research capacity: 'If the division of tasks to which George Waardenburg referred were to be carried out by the governments or departments, there would be a perfect capacity for development research at the Dutch universities. I agree that research capacity at our universities has "imploded" to a certain extent. What is left now in terms of research capacity is just a shadow of what was there in the early seventies. But, as George Waardenburg stressed: this cannot be the responsibility of the Ministry of Foreign Affairs/DGIS. It is the responsibility of the Ministry of Education and of the universities of which these institutions are part. Science policy is to a large degree delegated to university level and that is where the power battle is being fought in the Netherlands.'

North-South cooperation between research institutes

Mr E.M. Lammerts van Bueren (Tropenbos Foundation) explained that the foundation is heavily encouraged by the input of Dutch universities in its North-South cooperation programmes: 'The Dutch universities may have their own interest in studying certain issues, but they also like to encounter some encouragement from the Dutch side to continue their work. Should the cooperation between Dutch research institutes and those of the South be encouraged or be discouraged?'

Mr Ruitenberg: 'Cooperation on the one hand depends on recognition of each other's core competences. In my opinion long-term relationships between Dutch research institutes - which have generated a substantive body of knowledge - and institutes in the South are very important. In a long-term relationship a situation of mutual trust can be established, which makes it possible to hold discussions and have differences of opinion.'

Mr Frerks: 'The success of the cooperation between research institutes in the North and the South also depends on the way these joint programmes are structured. If the power equation enters the scene, and it is not very clear who exactly determines the nature of the cooperation, we need to be careful. When there is a more or less symmetric relationship in which each partner can bring their own strengths - and perhaps their own weaknesses - then it is all right. I think there are sufficient examples of good forms of cooperation, between institutions and also individuals, in this regard.'

One participant observed that Information and Communication Technology (ICT) could be used much more on a practical level. It makes it much easier for institutions from North and South to approach each other bilaterally. Institutions in the North could use part of their website to offer their expertise and their research lines, and policy-makers in the South could use the Internet to define their demands.

Demand driven research

The audience put forward a variety of issues relating to demand-driven research. Prof. J.A. Kusin of the Royal Tropical Institute applauded attempts to generate demand for research within countries but pointed out that there is a lot of research which goes beyond the boundaries of any one country. Such subject-oriented research provides answers to questions like 'what is to be done?', 'what is cost effective?', etc. **'**Multi-country studies have shown us, for example, that vitamin A reduces child mortality by 30%. This research is of course driven by the scientific community. Research is now being conducted to investigate why we have succeeded in reducing infant mortality in the past fifty years, but not adult mortality. What is the place of this kind of research?'

Mr Ruitenberg: 'In my opinion there are two interdependent approaches. The Ghanaian-Dutch partnership, for example, focuses on Ghanaian problems. On the other hand, there are problems in Ghana, like the HIV-2 problem which is less relevant in the Netherlands, but which is highly relevant for West Africa and which places the Ghanaian HIV-2 research in an international context. I think that this is an example of bilateral cooperation that will strengthen Ghana's capacity to participate in an international network.'

Mr Semboja reflected on the question of demand-drivenness and the choice of stakeholders which was discussed earlier: 'I think the concept of demand driven is country-specific. Which or what type of stakeholders are relevant for the formulation of research programmes is a function of the countries involved. The ministry in The Hague has been flexible on that. With respect to the place of subject-oriented research: scientific researchers are among the stakeholders in many countries. So they should be able to propose subjects which are relevant for them.'

Dr. W. Pelupessy (KUN-IVO) remarked that there are arguments why the exclusive demand-drivenness of development research should be reconsidered: 'One argument has to do with sustainable relationships with institutions, a point made by Mr Ruitenberg and Mr Frerks. I don't think that relationships can be sustainable if only the demand side is considered and not the supply side. Both should be made explicit. The problem is that until now, in many cases, only the demand side has been made explicit and the supply side is a hidden agenda.' Moreover, Dr Pelupessy feared that the ministry may have too large a say in what is demand-driven, defining the agenda and the outcome as well.

Mr Boer stressed that there is no exclusive demand-drivenness in development research and there should not be. He referred to the earlier discussion on the division of tasks between the ministries in which it is up to the Ministry of Education to guarantee Dutch research capacity.

Mr Semboja: 'We do have a capacity building component in many of our programmes, which takes into account that we are weak in certain areas. In Tanzania, for example, we sometimes have to get expertise from outside and this is where cooperation comes in. We need to strengthen a particular area, because it has actually been proposed by the stakeholders, but we don't have expertise in this area. The fact that we have to build capacity in certain areas means that we need assistance from partners of the North. At the same time this means that we also take into account the constraints from the other side.'

Gender

Dr E. Postel-Coster expressed her amazement: 'Why, in the year 2000, does a panel like the one we see in front of us here still consist of men only? I have heard a lot about "users", "stakeholders", "the poor", etc., and I only once heard the word "gender" - Professor Semboja referred to it. What kind of picture do you have in your mind when you talk about a farmer as a stakeholder? A forty-year-old man? Or the ones that really do the farming - the women? Why did RAWOO not invite two or three women for the panel?'

Mr Van Maanen: 'Let me at least assure you that gender is a topic at every meeting of the RAWOO board, a body with six female members. I share your embarrassment about the fact that we are sitting here, for one reason or another, with men

only. However, I must assure you that RAWOO has identified gender not as a separate subject, but as a subject that should permeate all issues that are on our agenda. So, in every RAWOO report you will find a separate paragraph on that perspective. Not as a kind of "excuse" paragraph, included because of "political correctness", but as a genuinely important issue.'

Mr Ruitenberg: 'During the agenda-setting of the Ghanaian research programme gender was an important issue. In my speech I mentioned that community appraisal was to a large extent focused on what women find important. That is also because in the programme much depends on the mother carrying the child to the local health unit for medical treatment. These women have to overcome the physical distance between the village and the centre where the vaccination is given. This is one of the issues that was thoroughly discussed and is one of the potential research questions.'

The role of policy-makers in implementing research results into policy

The audience made a number of final remarks on the relationship between researchers and policy-makers. Are the constraints that were identified in the 1980s, such as the lack of brokers or intermediaries, and the absence of state-of-the-art overviews still existent? And what about the capacity to absorb research results? Why do we problematize the role of the researcher when it comes to the relationship between the researcher and the policy-maker? Why don't we look at the role of the policy-maker? The Ford Foundation has always considered that the capacity of the policy-makers to absorb the results of research is an issue in itself that needs to be tackled. In relation to this, Mr D. Bol (CDP) wondered whether the new policy on the sector-wide approach in development cooperation was induced by research findings.

Mr Boer: ' The idea of tackling the absorption capacity of policy-makers has been an issue for a very long time. Some options that have been brought forward include the use of intermediaries, state-of-the-art papers (nowadays known as 'key-sheets') and a desk or a research coordinator at the Ministry as an intermediate. All of these issues are still on the table. However, one should not forget that there is a limit to the absorption capacity of policy-makers. As I said before, research results are only one of their sources of information.'

Concluding remarks

Rob D. van den Berg

First of all, I would like to thank the audience and the panel for the wealth of ideas and concepts that have been floating around during the discussion and making my task impossible. The chairman made it even worse by inviting me to give a wrap-up not only of this meeting, but also of my experiences in Brussels. However, given the fact that we all want to go to the reception, I feel that I should do that in a separate document, perhaps entitled 'The European Commission, my part in its downfall'. However, there is one anecdote about Brussels I would like to share with you, and that is that I had the privilege of kicking off George Waardenburg's celebratory year. Almost a year ago we had a seminar in Brussels about European research policy and I hijacked George to present a farewell gift to him during an informal dinner. Now, one year later, it is an honour for me to be present at the end of this celebratory year in The Hague. Also on behalf of my colleague Joan Boer, who unfortunately could not attend this seminar, I would once again like to thank George Waardenburg for all his efforts.

In my present function as director of evaluation at the Ministry of Foreign Affairs I am facing a similar situation to many researchers. Today's subject was the gap between research and policy. We see a similar gap between evaluation and policy. In fact, one of the godmothers of utilization of research results, Carol Weiss, has written extensively about the problems concerning utilization. A very important article from her hand is 'Evaluation for decisions: Is anybody there? Does anybody care?'[1] I have the feeling that this sentiment is also rife in the research community. Leen Boer has already given the answer for DGIS and I will not repeat it here. He represents the hierarchy; he speaks on behalf of Joan Boer. The task force that he mentioned shows that we care, and that we want to bridge the gap.

The other side of the question is whether researchers want to bridge the gap. In this regard I feel that one important question has not come up. I was a bit surprised about this. We have been talking about supply-driven and demand-driven research but, in my view, the whole discussion here was results-driven. The implicit assumption is that research results should be adopted and be implemented. I genuinely question that. Let me illustrate this point with an anecdote. A few years ago, I had the opportunity to attend a meeting in Washington of eminent economists who were discussing the impact of economic policy research on economic development. They claimed that their advice had earned the recipient countries billions of dollars. Therefore, would it not be justified for some of this money to be channelled back into economic research? Then one of the older economists stood up and said: 'If we want to reap the benefits of good advice, do we also want to pay the bill for bad advice?'

In this light I think Professor Semboja is very courageous and very bold to step into the policy debate in Tanzania and I congratulate him. This was the purpose of financing this kind of research programme. Courageous and bold, by the way, in bureaucratic terms are 'death sentences'. So let us hope that he succeeds. I give him all my best wishes and all our support in this regard.

Again, the question is whether we really want to bridge the gap. I assume that both the research community and the policy community want to do so. The question is how? Leen Boer mentioned the fact that, from the policy side, we would probably like something like a fast food or McDonalds kind of university that would come up with results like hamburgers. On the other hand, Georg Frerks said that we need a structure for communication. What kind of bridges would be appropriate and how could we prevent the fast-food delivery of research results to policy?

I believe that some important remarks were made this afternoon regarding important aspects of this topic. First of all, I believe that we should look at two other gaps. Georg Frerks mentioned one specifically: the gap between policy and implementation. This is a very important gap, which makes it very difficult for policy-makers to follow research results. Secondly, there is a gap between public awareness and reality. Public awareness is often mistaken. We know that, but unfortunately we cannot really do much about it. We have to try to influence public awareness in the right direction. Researchers are often much better at doing that than policy-makers, who sometimes feel constrained by the public debate.

With regard to the gap between policy and implementation, there are some important trends going in the right direction at the moment. First of all, there is a change in public management from an input towards an output orientation. A whole new range of concepts is emerging, such as output, outcome, results, effects, and results-based and resource-based management, all of which are

1. Plenary address for a meeting of the American Evaluation Association, Boston, Massachusetts, October 16, 1987.

designed to bridge the gap between policy and implementation. The aim is for policy-makers to improve their perspective on reality, on what works and what does not work. Here researchers can help. One of the roles of research is to provide us with new views on reality, so this is an important opportunity.

Secondly, there is a shift, especially in development cooperation, from project level support to programme, policy and even sector-level support. This shift enables research results to be used on a higher plane. Dick Bol asked whether minister Herfkens had taken a look at research results to justify her bold changes in Dutch development cooperation. She claims that the World Bank's 'Dollar Report' on aid effectiveness was an important input in her decision to concentrate aid and shift to a sector-wide approach.

To move on to the question of public awareness and reality, and to follow up on this question of the higher level, I would like to say something about structural adjustment and the failure of capacity building. Capacity building has been mentioned time and again by many people at this meeting as the crucial way to incorporate research into civil society. However, structural adjustment was instrumental in breaking down many efforts towards capacity building. Although this was never clearly stated, at a certain moment in the process leading up to structural adjustment decisions were taken that reflected the opinion that basic research and universities are a luxury that poor countries cannot afford. Whatever the reasons were, financial resources for research institutions and for basic analytical and statistical institutions in most developing countries were diminished. Often civil service reform was supposed to be part of structural adjustment, but it almost never really took place. This, of course, is a crucial issue when talking about capacity building. If the civil service does not have the correct function, with the right structure and remuneration, capacity-building efforts will not be sustainable in the long run. I predict a second phase of structural adjustment in which basic analytical capacity in developing countries will be rebuilt through civil service reform. I am certain that research will be part of that effort.

All this is part of a larger question: that of good governance. This simple term, which nobody has defined adequately, stands for a broad range of concepts where we discuss the whole question of power in society, stakeholders, conflicts of interests, checks and balances and so on. The view now is: in order to have a 'good' government in countries you need to have a functioning civil society in which research plays an important role of increasing public awareness. If we look at the great influence that research has had on development issues over the past decade, we see that, through public awareness, discussions started on issues like gender, environment, climate change, and biodiversity. Stein Bie mentioned that these are donor cycles. In fact, in many cases, they are cycles driven by research results. Research results enter into the public debate and put an issue on the agenda for policy-makers to deal with. This is the roundabout way in which we often incorporate research results.

This can be a slow process. Professor Semboja mentioned a time-gap between research results and their implementation of three to four years. Our evaluation department has recently looked into this matter and we found that the gap between a major new insight entering public awareness and its translation into policy usually is about five years. Furthermore, there is a second time-gap of about five years before the new policy is put into action, due to the general gap between policy and implementation. So, what are we talking about? You may want policy to be driven by research results, but please take note of this ten-year time-gap and adopt a longer time perspective when presenting them.

A large part of the discussion was about process. Process is to ensure the involvement of stakeholders. Process is enormously important, but I would also like to express a warning. The American sociologist Richard Sennett recently discussed the emphasis in the 'new economy' on knowledge management and knowledge-oriented processes[2]. In his view, these knowledge-management processes have become almost completely divorced from content, especially in the United States. They have become techniques that can be applied in any industry, in all circumstances. The danger is that they continue for the sake of the process and he warns us to not forget that in the final analysis we need content. We need the substantial issues. A good research result speaks for itself, regardless of the process leading up to it.

2. Richard Sennett: 'The Corrosion of Character' (see *de Volkskrant*, 3 June 2000).

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I fully agree with Professor Semboja that if you have a good result then at a certain moment somebody will listen, even if it is after three, five or ten years. For this reason I very much applaud the announcement of Leen Boer that the ministry is preparing a 'lessons-learned report' on the last decade of research policy. This means that the George Waardenburg's celebratory year is not over yet! We need to continue for at least another year and have another meeting to discuss these lessons.

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Epilogue

Epilogue: reflections on the utilization of research

George Waardenburg

These notes reflect on the utilization of research within the framework of the RAWOO lecture series and its concluding meeting. They are therefore primarily concerned with utilization within the context of development and development cooperation. They try to avoid simply repeating what has already been said in the various lectures, but may nevertheless underline some points which were made earlier, in addition to drawing attention to a few new ones.

From the various contributions it has become clear that utilization of research is a rather elusive concept. Recognizing this appears to me rather important. My own experience in dealing with this issue at the Ministry of Foreign Affairs is that the naïve, intuitive notions about it which I held at first - presumably together with many academic colleagues and members of the public - are inadequate, if not counterproductive. Examples of such notions are the linear model of processes of research and application, and the idea that for many development problems research has available ready-made solutions which are only inadequately communicated to policy-makers and implementers. But the same experience has taught me that further analysis of the nature of this concept can lead to useful general and practical insights.

One of the reasons for the persistence of rather naïve notions about the applicability of research appears to be the visible success of science-based solutions to practical problems in the medical and agricultural field and in engineering. While many of such 'solutions' may have had double-edged implications within a wider societal framework, they have suggested at least a certain one-to-one correspondence between research efforts and tackling practical or policy issues. Thus the expression 'utilization of research results' may evoke images of solved problems, which do not correspond, however, to the realities of the societal impact of research in the social sciences and humanities. Therefore it appears wise to keep disciplinary distinctions in mind when discussing the 'utilization of research results', and at the same time to look for a general conceptualization of the societal impact of research, from which insight into the utilization of research may be derived**.** I hope to have made a contribution to this conceptualization in my introductory lecture, when I outlined the different societal roles of research and the different kinds of knowledge which may play a role.

Another factor which makes utilization of research results an elusive concept is that it appears very differently when seen from the researchers' view point than from the users' point of view. For the researcher the research or its result is the given thingwhat matters, even if he or she recognizes that it is based on simplifications, while its utilization is rather unclear, uncertain, ambiguous or invisible. For the user, however, the problem or potential decision is the given thing, even if it is not fully clear in all its ramifications, but it is the research results which could be utilized that are unclear, uncertain, ambiguous, invisible, etc. Neither the researcher nor the potential user may be aware of this difference in viewpoint. They may only wish for 'more contact' between the two different worlds, which however need not lead to a better utilization of research unless its structure has been better elucidated.

But utilization of research is also elusive at the level of the concrete reality. Weiss (1979)[1] found in empirical research among users of research seven different meanings of the idea of utilizing research. If not elusive, the idea is certainly multi-faceted. But which of these meanings does the researcher think will be applicable to the possible utilization of her or his research? And if, for whichever meanings have been chosen, this utilization does not appear to be not happening, what does she or he think to be the cause of this:

a. a possible misperception of what actually happens[2]
b. non-applicability of the results;
c. a lack of communication of the results to the potential user;
d. unwillingness or mediocrity on the user's part;
e. something else.

If researchers are interested at all in the utilization of their research, they may act differently according to how they answer these questions. And the other way round potential users may themselves very different ideas about research utilization, which may influence their expectations and behaviour in that area.

Looking a little closer at the world of researchers and in particular the world of the universities, we see that until recently there were generally few incentives to strive for utilization of the research performed. In fact, in the academic culture, there has been an element of disdain about utilization of research (admittedly less so in recent times) and in general about the vulgarities of the outside world.

1. Carol Weiss 'The many meanings of research utilization', Public Administration Review, September - October 1979, pp. 426 - 431. See also my introductory lecture in this series on 'The utilization of research results at the Ministry of Foreign Affairs: points of departure' (pp. 9-12 above).

2. Remember Weiss' 'Knowledge creep and decision accretion' in *Knowledge, Diffusion, Utilization,* Vol.1, No. 3 (March 1980) pp. 381 ñ 404, which underlines this invisibility. See also my lecture on 'The utilization of research results at the Ministry of Foreign Affairs: points of departure' (pp. 9-12 above).

Discussions between academic researchers only rarely contained useful ideas about utilization. This was not a lack of ability but rather a reflection of a prevailing culture; in non-university settings - e.g. private enterprises or government institutions - this is much less of a 'problem', if at all.

As for the world of potential users of research, or 'stakeholders' (to use the now very common term), there is a considerable diversity in interest, societal outlook, power and organization. In addition to the governmental organizations and private enterprises already mentioned, there is the vast world of 'civil society' (e.g. patient or consumer groups, labour unions, environmental groups, religious groups; generally speaking NGOs or grassroots movements).

These civil society groups have in general fewer opportunities or financial instruments to steer research in the directions of their problems or interests and may therefore be less used to or inclined to make their researchable concerns explicit than government institutions or private enterprises, even though they may be as much affected by research results as the latter.

Anyone wishing to further utilization of research by structuring a kind of dialogue between the worlds of research and of potential users is in for a complex task, in view of what has been noted above and of the complexities of research processes not discussed here. The government may have a double role in this dialogue, being both provider of conditions for research in general and a potential user of research results. In the Netherlands one interesting model for structuring such a dialogue has been developed in the form of the sector councils. Remarkably this model, notwithstanding its transparency and the fact that it is deeply embedded in the democratic parliamentary structures, has found limited application in terms of areas covered. The essential added complexity in the case of development research, because of the North-South distinction, has been dealt with by ensuring that at least one-third of RAWOO's members come from the South.

Enabling such a structured dialogue certainly fulfils a useful condition for the utilization of research, but by no means a sufficient one. To really further the utilization of research a further effort must be made, not only by researchers but also, and probably primarily, by the groups and institutions of potential users. They themselves have to make up their mind explicitly and consciously on what points and issues they think research may provide them with useful insights, as distinct from what they get from the many other sources of information, traditional or non-traditional 'local knowledge', which they have access to.

In doing this, the users of research could consider the wider functions of research as well as the kind of knowledge needed, both of which were mentioned above. In this way they may come nearest to the second (problem solving) and the third meaning (interactive model) of the utilization of research as discussed by Weiss (1979)[3], but in a more active and creative, and therefore more effective, way than described by Weiss and possibly combining it with other models of research utilization. The result of such own analysis and pondering by the users of research may not lead necessarily to new contract research but researchers may tie in with it in various other ways, like clarifying the relevance of outcomes of research they have done or are otherwise familiar with and pointing out its limitations, helping to sharpen or deepen the formulations of the problems identified by the users, or taking them up in their own further research programmes. Anyway, all this requires from both users and researchers a considerable extra effort, with more innovation, seriousness and commitment than they might be used to in user-researcher dialogues.[4]

In this connection it is relevant to mention the interesting results of a practical investigation conducted at DGIS in the mid 1990s by Frederiek Knoet, a student from the Erasmus University Rotterdam. She looked at a group of research activities which were financed by DGIS and which were intended to be useful for the design or implementation of development cooperation policies at the ministry and investigated which factor(s) influenced the utilization of their results within the ministry. She found one decisive factor for such utilization: that the initiative for these activities had arisen within the ministry itself and that they were not only carried out at the suggestion of researchers from outside the ministry. This finding gives food for thought.

This whole discussion during this RAWOO series about the utilization of research does not take place in a societal vacuum. There is not only increasing pressure from society and governments on the S and T system in many countries to deliver more goods which are 'utilizable'. Also, within the

3. See my introductory lecture 'The utilization of research results at the Ministry of Foreign Affairs: points of departure'.

4. The 'BeWe sessions' at DGIS and the Ministry of Foreign Affairs announced in Leen Boer's paper at this seminar, may be most helpful and a good example of such an extra effort, especially if they are limited in scope, concretely focussed and involve the ministry's participants beyond simply listening to the researchers.

system of production of knowledge as a whole, considerable changes are taking place in the direction of more producer-user dialogues, more networking, more multidisciplinarity and more focus on utilization. Gibbons *et al.* (1994)[5] even speak of a more or less revolutionary 'new mode of production of knowledge', a 'Mode 2', which emerges alongside the more traditional 'Mode 1' of (semi-)permanent institutions, organized largely along disciplinary lines. When I came across this publication during the preparation for this RAWOO seminar I was struck by the relevance it has both for the subject of the seminar and for providing a perspective on DGIS research policy over the last decade and on the efforts of RAWOO. It is, however, beyond the limited scope of these notes to more than mention this reference and recommend that you read it.

I hope that this publication as well as this laudable RAWOO series and seminar may contribute to further creative thinking and acting on the important issue of utilization of research for development and development cooperation.

5. Michael Gibbons e.a., *The new production of knowledge. The dynamics of science and research in contemporary societies.* Sage, London, etc. 1994.

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Utilization of research in north and south
A review of recent literature

Annex

Jack Spaapen, assisted by Frank Wamelink

Contents

1. Introduction

The Netherlands Development Assistance Research Council (RAWOO) asked us to write a critical review of the general literature relating to the topic of research utilization. RAWOO wanted an overview of what had been written lately on the topic, not only in development literature, but in general. Additionally, the Council wanted to know how new developments, particularly in information technology and knowledge management, might be of interest for research utilization. Finally, we were asked to come up with suggestions for policy to further the use of research.

This assignment was part of RAWOO's efforts to stimulate the debate on utilization of research. The topic was studied and debated extensively in the late 1970s and the 1980s (Weiss 1979, Bulmer 1986, Lindblom and Cohen 1979, Läpple and Maan 1984) but later interest somehow diminished. A draft version of the review ('a quick scan') was presented as a background paper to participants of a RAWOO seminar on utilization of research, held on 14 June 2000 in The Hague. The discussions at the seminar enriched the current version on several points.

Approach

We began by examining literature written in the last ten years, contained in the three ISI databases (SCI, SSCI and A&HCI; see appendix). We searched the three databases for literature written in the last 10 years and immediately became aware that 'utilization' does not occur often in the titles of articles. Instead, it appears under a variety of other topics, mostly related to areas such as research and policy, innovation, diffusion or transfer of knowledge and technology (Rip 1995), and learning processes. It also became clear that 'utilization' as a key word is found more frequently in some sectors (health, education, agriculture) than in others. Arguably, these are areas where research is closely connected with concrete social practice (nurses, schoolteachers, farmers).

There are a number of reasons for the fact that utilization of research is not often addressed directly as a separate subject for descriptive study. (We did find a number of case studies that did, but very few were of the more reflective kind). As has been observed earlier, the concept of utilization has many meanings (Weiss 1979). We believe, that utilization has become more elusive as a concept as a consequence of the changing modes that have

been observed in the research production process (cf. Gibbons *et al.* 1994).

This review, therefore, adopts a broad focus. In order to understand utilization of research (and find ways to improve it), its place in the context of the modern research and innovation process needs to be reviewed. This basically means reviewing the different parts of that complicated process, in which different 'stakeholders' take part and exchange different knowledge and expertise. These stakeholders have different interests, expectations, norms and values that have to be negotiated in some way. For example, researchers who apply for funding from the state or elsewhere because they are interested in a certain problem, have to deal with the 'stakes' of the policy-maker. How do they 'use' that information in developing their projects? Policy-makers, for their part, might be searching for independent and reliable information on a particular subject. Or, they might be in need of specific information to support certain claims or policies because they have to deal with the claims of others in the political debate (see In 't Veld, 2000:135). In other words, research can be used in different ways. Still other stakeholders take part in the process, perhaps with 'non-scientific' knowledge, expertise and expectations. For instance, rural people who want to be involved in research into their ecosystem might bring in their own social, economic, environmental and spiritual values (Gichuki 1999). The question that inevitably comes to the fore in reviewing these different 'stakes' that appear in the literature, is what is meant by 'use' or 'utilization'? To be more precise, where does use start, and where does science end?

One consequence of the above is that it is even harder to give a good definition of the concept of research utilization than it was before (Boer and Box 1994: 161). We propose the following working definition, starting from the assumption that most authors now see research utilization as an integral part of the innovation process as a whole.

Research utilization, obviously, refers to the actual use of results of research. But it can also refer to the exchange of information between different actors in the innovation process about the research programme. In this communication various expertises are exchanged, or used. Also, research utilization entails both explicit and implicit forms of use since tacit knowledge can be an important element in innovation.

Outline

This paper is structured as follows. Section 2 contains a general overview of the topic of research utilization as found in the literature and in policy discussions over the last decade. Section 3 describes the innovation process in terms of its principal actors and their role in research utilization. We review three 'user' or 'stakeholder' groups (policy-makers, professional users and end-users) and show the different implications of each with regard to utilization. Utilization has rather different meanings in each case, and researchers interact in different ways with each of these groups. Policies that aim at improving utilization need to recognize these differences. Section 4 analyses the concept of utilization along the lines of three themes found in the literature: changing ideas about knowledge production, their implications for policy development, and the political consequences in terms of power and cultural differences. Section 5 elaborates three emerging issues relevant for utilization: ICT, knowledge management and contextual evaluation. Finally, in section 6, we draw the main conclusions.

2. Utilization: its place in the literature and in policy discussions

2.1. Literature

Utilization of research is found in at least two sets of literature. One is literature that is oriented towards the policy process. Much to our surprise most studies that focus on the research-policy-utilization relationship seem to take the end-user for granted. They tend to focus on the interaction between researchers and policy-makers (see for example In 't Veld and Verhey 2000) and not so much on utilization in wider society. The second set of literature entails research in the area of science and technology studies and in particular on innovation, including (constructive) technology assessment. In this, the focus over the last decade or so has been on networks and on actors in those networks.[1] End-users traditionally receive more attention here, particularly regarding their specific contribution to the innovation process (Freeman 1974). A classic sociological discussion is found in Von Hippel's article on the dominant role of users in the development of instruments (1976).

From the literature, it becomes clear that utilization refers to at least two general categories, which might have rather different implications for the question of how to improve it. The first one refers to the use of research to improve or support certain

1. Innovation studies as a field has been described as arising 'out of the tension between the commonly held view that innovations emerged as a result of isolated instances of creative and entrepreneurial genius and the more credible position that the innovators were part of a larger community and a more continuous pattern of historical development of both technical and economic systems.' (Green et al. 1999) The question then became how to analyse the wider context comprised of social, economic and technical elements from which innovation arises. Callon (1992) has presented the notion of techno-economic networks (TENs) as a solution for the linking of the 'social' and the 'economic'. He brings together economic writing about the circulation of intermediaries such as money, contracts, etc., and sociological notions about how actors are defined through their relationships.

policies of governments themselves (*research for policy*). The second category refers to the use of research to improve certain situations in society, in the North or the South (*research for society*). In the first case, improving utilization largely means reviewing the government's internal 'knowledge management' processes. In the second case, it means government has to review its role as an intermediary in a social process.

The literature shows that over the last decade or so, the concept of user has blurred, arguably in concurrence with changes in the conceptual approaches of the research and innovation process. One expression of this is that the difference between the user and producer of knowledge has become less clear, a development that is shown in the literature by a growing preference for the word 'stakeholder' over the word 'user'. Stakeholder then comes to refer to any actor having a 'stake' in the research and innovation process. This does not, of course, mean that users and producers have become interchangeable, but that their roles in the knowledge production process overlap more than they used to do.

Most authors now commonly typify the process in which scientific research is eventually turned into something that is utilized as innovation, broadly defined. That is, innovation is seen as both technological and socioeconomic progress.[2] They view the process in much more interactive terms than was the case a couple of decades ago. Instead of a more or less linear process, in which fundamental knowledge is turned into something useful through some kind of transfer mechanism (a science shop for example), innovation is now seen as a much more dynamic process. Researchers, policy-makers, industry, consumers, technical experts, etc. operate in iterative interaction and mutually influence each other (Gibbons *et al.* 1994:17).[3] All these 'stakeholders' somehow work together on solving problems. One consequence of this perspective is that it is difficult to distinguish utilization as a separate category. The 'user' is turned into a vital part of the innovation process as a whole, and is no longer a user in the sense of a passive consumer. Moreover, various stakeholders may take on the role of user and of producer. Researchers produce knowledge, but they may also use knowledge from other stakeholders.

With respect to research in developing countries, such dynamic forms of interaction are widespread. The RAWOO publications (1998a, 1998b) on the development of research cooperation programmes in Ghana and the Philippines are examples of this. How widely this is accepted nowadays was shown in a recent meeting on North-South research, organized by the Royal Netherlands Academy of Sciences, where case studies were presented. There it was concluded that the research paradigm is changing, and that 'the time has passed when North-South research was basically seen as a method of technology transfer' (KNAW 2000: 8). It was further noted that 'researchers increasingly become players on the global and local market, where demand rather than supply orientation is the guiding principle. Demand orientation requires increasing stakeholder participation when formulating and executing projects' (p10). The researcher increasingly becomes a 'knowledge broker', a position not free from political implications. An apposite example is the 'independent panel of leading scientists' from North and South that recently endorsed the use of genetically modified (GM) crops to meet the 'food needs of the world's poor.' (Nature 2000:115). The panel members offer a 'technical reflection on the GM debate', but at the same time are careful to 'place the technical dimensions of GM in a broader context'. Their report demands special exemptions for poor farmers to protect them from inappropriate restrictions on propagating their crops.

2.2. Policy discussions

In the policy process, somewhat parallel to what can be seen in the literature, utilization is a topic of interest but is often hidden behind other issues. Usually, the general question posed is whether research should be explicitly relevant for society (or should be left to the more or less idiosyncratic interests of researchers). The specific theme of such policy discussions might be the 'demand orientation' of research programmes, 'needs assessment', or 'linking'. Often in these debates, the prime focus is on the relationship between scientific research and government policy, not on utilization as such. In the area of development studies, the relationship between government and research has been the subject of many discussions and studies in the last 10-15 years (Schweigman and Bosma 1990, Waardenburg 1991, Schweigman and Van der Werf 1994, DGIS 1994, Boer 1991, Boer and Box 1994, Spaapen 1997).

The debates between the research community and the polity about the relevance of research have been rather controversial overall, in particular when the social direction and/or the demand orientation of

2. Research and innovation are used together or sometimes separately in this paper. They refer to the same process in which new knowledge is developed and ultimately used for socioeconomic and/or technical innovation.

3. A parallel development, arguably coupled with the above one, can be seen in the patent process. Patents used to be a much more straightforward outcome of the product development of one group or individual. Now, patents are much more often pieces of research resulting from large cooperative efforts.

research were discussed. The focus of the larger debate (that is, including general policy issues) has shifted over the years, arguably in connection with changing views on the relationship between science and society. During and after WWII, it seemed self-evident that research ('operations research') was useful and served policy goals (this was accepted long before that in colonial research policy; see Spaapen 1997). But the strong image presented by C.P. Snow in his 'Two Cultures' (1959), which opposed science and culture/society, led to a broad awareness about the different goals, interests and expectations of the two social spheres. For a while, in the late 1960s and the 1970s, science was able to present itself as being most effective when left untouched by policy intervention. Later, when universities turned into mass institutions and budgetary matters became more important, questions about the relationship were drawn into the political-administrative sphere (e.g. the 'quid pro quo' debate of what research can do for policy and vice versa; Blume 1986). It was the beginning of a stronger insistence on the part of government that research be 'useful', and the idea that researchers should account for that. Later still, the interaction between the two spheres grew more intense, and expectations that research be useful for society similarly increased. More recently, the literature shows a growing integration of science, government and societal actors, such as industry and NGOs, partly as a result of specific government policies (Wilts 2000). As a consequence, we see a growing interest in more specific user/stakeholder-oriented questions both in the literature and in national and international policy circles (Shinn *et al.* 1997, Spaapen and Wamelink 1999, Den Hertog 1996 (a report for the EU), Zurich IT 2000 Conference, World Bank 1999).

A clear example of this changing focus is the policy turn made by Dutch development minister Jan Pronk in the mid 1990s, in which the demand for relevant research for development was connected directly to Southern needs, i.e. to users in the South. This change of policy led to the development of user-oriented programmes (MMRPs) and helped stimulate debates about who sets the agenda for research. Notwithstanding the fact that there is broad consensus that development research should be, for the better part, demand-oriented, it is not yet clear how the user-orientation may be improved.

We found that discussions about utilization tend to be greatly affected by the way the process of innovation is perceived. In particular, this concerns the ways in which knowledge ('research results') is transferred to practice. Because of the elusiveness of the product 'knowledge', it is rather difficult to determine what the *use* of research exactly means. In practice, knowledge is transferred in a variegated interaction between the research community, government, and actual and potential users. In this process the knowledge itself, because of its elusive character, is also transformed in terms of its meaning. Arguably, this is even more so when it moves into a different cultural context (Apffel-Marglin and Marglin 1990, Long and Villareal 1993). That transformation (or translation) process, the social mechanisms that make up the interface between knowledge and utilization, determines to a large extent the utilization of research.[4]

In the literature, we found at least three different ways ('models') of viewing the research-policy-society relationship. And since these different perspectives ultimately affect the ways research utilization policies are shaped, we present them here in brief.

1. management model: science as robust problem solver; other stakeholders play a subordinate role
2. public arena model: science as one of the elements in problem solving, subject to public debate; all stakeholders may participate in the debate
3. transdisciplinary model: science, jointly with other forms of non-scientific expertise, strives for problem solving: users are part of the team

The models are analytically distinct, but they can overlap in practice. In each model, users/stakeholders play a role (of varying importance). Furthermore, 'use' or 'utilization' are seen as an integral part of the innovation process as a whole, again to different degrees.

3. Utilization in terms of three user groups ('stakeholders')

Three groups of users/stakeholders are distinguishable in the literature, each with a different position in the research and innovation process:

1. policy-makers, whose goal is either to use research for their own policies, or to facilitate the transfer of knowledge from science to society

4. In a recent article (Landry *et al.* 2001) an empirical model for knowledge utilization is developed and tested. Instead of limiting utilization to instrumental use, the paper defines utilization as a cumulative process, based on six stages of utilization distinguished in the 1980s by Knott and Wildavsky. These stages aim at covering the variegated social mechanisms of the interaction between research and social context: transmission of research results; cognition by practitioners and professionals; references (citations etc.); efforts to further develop the research results; influence on choices made by practitioners and professionals; application.

2. professional users within industry and the not-for-profit sector who want knowledge to develop products and services; researchers who profit from developments in other disciplines may also be included
3. end-users; that is, the public at large or specific target groups (for example farmers, aids victims)

When considering the issue of research utilization and ways to improve it, each of these groups' demands and contributions to the innovation process need to be taken into account.

3.1 Utilization and policy-makers

Contingent effects of research on policy

If we go back to the two types of use we distinguished in the previous section ('research for policy' and 'research for society'), it appears from the literature that the evidence on the effects of research on policy is rather paradoxical. In 't Veld (2000) quotes a study by Hisschemöller *et al.* and remarks that the utilization of knowledge by policy depends on a number of factors which have nothing to do with 'hunger for knowledge' and everything to do with the question of whether research results can serve certain policy goals. The extent to which consensus exists with regard to an issue influences utilization. The more conflict there is around an issue, the less people tend to rely on 'objective' knowledge. Instead, they tend to look for knowledge that supports their position. Davis and Howden Chapman (1996), reviewing the health policy sector, conclude that, 'while there is scant evidence that research has had any impact on the direction or implementation of widespread health reforms, research on evidence-based medicine has dramatically increased.' Clearly, effects of research on policy are also contingent on the social sector concerned and depend on various other factors. At the beginning of the 1990s, DGIS had already concluded that the effect of research on policy partially depends on the kind of research that is conducted, and on the goals of the particular research programme. To build or strengthen institutional capacity in countries obviously requires a very different kind of research than that conducted to monitor or evaluate certain policies (Boer 1991:5). Different actors are involved in each type of research, different problems are encountered, different solutions sought. Models found in the literature on the relationship between research and policy range therefore from empirical research rationally informing decision-making, through research incrementally affecting policy, to 'enlightenment' or 'infiltration' models, which may operate on a conceptual level (Davis and Howden 1996). The research field most likely makes a difference too. In order to affect policy, health research that contributes to large-scale socio-political change may require more methodological pluralism and greater focus on key institutional structures than, for example, crop research.

Different ways of 'using' research

The relation between knowledge producers and policy-makers is clearly not a straightforward producer-user relationship. A study into the development of a national desiccation policy in the Netherlands and the implementation of desiccation plans in local situations points to differences of three kinds which affect the relationship (Boogerd *et al.* 1997). In the first place, there is a cultural difference between producers and users; they live with different norms and values that may conflict. Secondly, different rationalities underpin the policy-making and research processes.[5] Thirdly, different knowledge stocks are used depending on the framing of the policy problem. A study carried out in the education sector underlines this point (Johnson 1999). It examines the politics of using information generated by research by asking the question: Once research results have been produced, how are they used? It concludes that the value-laden nature of any research provides policy-makers with an important resource to further their political agendas. Information can be subject to numerous interpretations, and policy-makers who have the skills to use research information can frame the issues and solutions in ways that are compatible with their interests. In other words, the definition of an issue or problem is socially constructed. Another study from the same sector (education) analysing the policies of two US states with regard to early literacy instruction concludes that the two states' curricular policy statements were highly selective in their use of research evidence (Dressman 1999).

The above shows that structural differences between users and producers of knowledge and sometimes opportunistic interpretations and goals by policy-makers play a role when it comes to utilization of research results. Also relevant here are differences in aggregation level. The Boogerd *et al.* study mentioned above demonstrates the emergence of a policy issue at national level in close interaction between knowledge producers and policy-makers. But interactions at the local level

5. This point was underlined in another case study analysing the usefulness of climate change research for managing salmon runs in the Pacific Northwest of the USA (Jones *et al.* 1999). The study shows that policy-makers can be receptive to research that is relevant to them, yet be unable to use it because it is not formulated in ways compatible with current decision-making models.

were based more on the integration of expert knowledge through personal expertise and closely tied to the development of management plans. This case study thus reveals a difference between general knowledge-supporting measures at the national policy level and the way in which specific knowledge is applied in local cases. The study concludes therefore, that more attention should be paid to the translation of policy problems from the higher levels of political authority to the conceptualization at lower management levels.

3.2 Utilization and professional users

The accidental interest in users

There is something strange about the attention given to users and utilization in the category of professional users. Rhetorically speaking, there seems to be great consensus about the importance of relations between producers and users of knowledge. But, while the production and utilization of knowledge is closely tied to politics (Cozzens and Woodhouse 1995) and the relationship between science and the state understandably gets prime focus in many studies, the relationship between the producer of knowledge and the professional user receives insufficient attention in the literature. This is more so for users in the not-for-profit sector (farmers' organizations, health-care workers, environmentalists) than for users in the commercial sector. And, arguably, it is even more so for users in developing than in developed countries (partly because the latter are generally better organized or represented). In general, there seems to be more discussion *about* users than *with* them (Cornwall and Jewkes 1995). A telling conclusion in the Den Hertog study is that 'in many cases, the problems of users are not identified, even when the information is available' (1996: 16). Apparently, it is difficult for producers of knowledge to see the relevance of users' problems. The study reviews a variety of users, both in industry and in the not-for-profit sector, and concludes that problems are only seen once products or services are actually used.

Industry

With regard to the professional users in industry, there is a wide-range of literature on economic and technological development (innovation). The importance of the relation between producers of knowledge and users in industry received attention in the 1970s and even earlier (Freeman 1974, 1991). Studies originally focused, among other things, on the role of users in helping the marketing of products and technological innovation (Woolgar 1991). Later, more critical roles of users were studied, particularly in studies regarding technology assessment (Schot 1992). A general conclusion that emerges from this literature is that utilization is largely improved by collaboration (research projects, articles), and particularly when university researchers cooperate with firms at the local level (Tornquist and Hoenack 1996). But the performance of research can also be enhanced, as an example from pharmaceutical research shows (Cockburn and Henderson 1998). Their article shows a strong correlation between what is referred to as 'connectedness' (between private and public research) and performance.

Without going too deeply into the literature, we would like to point out that there appear to be important differences between Northern and Southern contexts. To give one example that concerns the relationship between science and technology in the context of the economic conditions in developing countries: Lall (1993) concludes that there is generally no support in developing countries for the applicability of hierarchical models of the relationship between science and technology. He calls for a reassessment of development policies based on the assumption of such hierarchical relations. This fits with the approach of the research and innovation process as a non-linear, iterative development between various expertises. Another example is the counterproductive effects of institutional *isomorphism* (that is, emulating Northern institutional structures) on the production and utilization of knowledge (Shenhav and Kamens 1991).

Not-for-profit sector

Over the past decade, there has been increasing interest in the public user side of the research and innovation process. Especially in sectors like health and environment, and also in the education sector, stakeholder models are being introduced as a way of improving utilization (see Van der Weijden and Ruitenberg 2000, and RIVM director Klaas van Egmond at a recent KNAW symposium). These sectors are characterized by a clear applied or policy-oriented focus for research and established social practices. Successful utilization of research is relatively easy to achieve (at least theoretically) in sectors where there are close ties between basic research and practice. This is true in medicine, for example, with the clinical practice in university hospitals (now even more so, since most scientific

departments have merged with the hospitals). Nurses are readily involved in evaluating the use of certain research results in clinics (Kajermo *et al.* 1998)[6]. Clearly, these interactions are in the interest of both producers and users, who want to produce and use usable knowledge. The importance of good interaction between basic research and practice was shown recently by Hein Wellens, professor of cardiology. In an interview in the Dutch daily newspaper *NRC Handelsblad* (22 April 2000) he revealed that a gap had developed between basic research and clinical practice in cardiology in the Netherlands, when basic researchers turned to molecular and genetic techniques and practitioners did not follow. As this happened in one of the best organized medical specializations in the Netherlands, a country with a very well-organized research system[7], one can only realize the potential danger of failing interaction in most developing countries (cf. the Ganuza dilemma[8]). Clearly, building education and research capacities are among the first conditions for improving utilization.

The dark side of this close connection between basic research and practice appeared recently when the editor in chief of the *New England Journal of Medicine* started a debate about the close ties between the pharmaceutical industry and researchers. She instigated the debate after having published an article by a group of researchers about the treatment of chronically depressed patients that named all the industrial sponsors of the research project. The list of sponsors took up two and a half pages (*de Volkskrant* 27 May 2000).

3.3 Utilization and end-users

Conflicts between knowledges

End-users are important targets of research-based policy measures in many sectors (health, education), but certainly in the context of development policy. Most research projects seek some kind of user involvement to improve the chances for utilization. Major points for discussion are the differences between scientific knowledge and other types of knowledge, and the question of how to deal with these differences (see for example Harding 1997). But the boundaries between knowledge creation and knowledge utilization, between research and practice, are becoming vague. Hargreaves (1996) describes the interaction between academic discourse and teachers' self-generated knowledge, and researches the possibilities for productive interaction between the two. As a general point, it has been noted that policy conflicts arise when local-level initiatives interface with the effects of macro-policy-initiated changes (Sutherland *et al.* 1999). To deal with these implications and potential conflicts, a variety of research methods have been developed to involve end-users, their knowledge and expertises in the research process. The most well known, perhaps, are the various branches of participatory research and action research.

Research methods that involve users

The key characteristics of participatory research are that it is client-driven, requires decentralized technology development, leaves the major responsibility for adaptive testing to end-users (such as farmers), and requires institutions and individuals to become accountable for the relevance and quality of technology on offer. This is what Ashby and Sperling (1995) conclude in an article which draws on case studies from Latin America, Asia and Africa. It reviews the ways in which institutions have responded to these characteristics of participatory research and raises issues for further elaboration. The argument that participatory research and development alone is insufficient to deliver innovations relevant to diverse client groups. Policy mechanisms are required to define which clients are to participate, whose agendas are to drive the process, and what organizational innovations are needed to move agricultural research and development in these directions.

Research strategies that emphasize participation are also increasingly used in health research (Cornwall and Jewkes 1995). Participatory research here breaks away from traditional linear research models and focuses on a process of sequential reflection and action, carried out with and by local people rather than on them. Local knowledge and perspectives are not only acknowledged, but form the basis for research and planning. Many of the methods used in participatory research are still drawn from mainstream disciplines and conventional research itself involves varying degrees of participation. However, the key difference between participatory and conventional methodologies lies in the location of power in the research process. Participatory research raises personal, professional and political challenges, which go beyond the bounds of the production of information.

Maruyama (1996) examines research and theory in action research. Action research is collaborative,

6. The article discusses a survey that was conducted to describe registered nurses' perceptions of the barriers to and the facilitators of research utilization at two hospitals in Sweden. Though the results are case specific, they arguably contain wider implications. The major barriers to research utilization were that the research is not readily available, together with inadequate facilities for implementation of research findings, lack of competent colleagues with whom to discuss research, lack of time for reading and implementing research findings and nurses' lack of authority in the organization. Nurses who had studied research methods in their basic training seemed to perceive fewer barriers than those who had not. The facilitating factors most frequently suggested by the nurses were diverse models of education to increase their knowledge of research methods and to develop skills in evaluating research findings. The allocation of resources for education and implementation of research findings in clinical practice, in addition to special positions in clinical practice for nurses with scientific qualifications, were also suggested.

7. The national research system of the Netherlands is a modern system, with an intermediary level between the state and research institutes, and with increasing pressure for science to be relevant. The Netherlands is unique in the density of institutions at the intermediary level and the institutional competence in heterogeneous aggregation processes for agenda building and implementation (Van der Meulen and Rip 1998).

8. The Ganuza dilemma refers to the lack of an active interplay between a dynamic scientific community, a productive sector and a political society ñ a necessary condition for effective development research (Ganuza 1990).

driven by a partnership between theorists/researchers and practitioners; it focuses on both theoretical and practical implications of issues. Action research focuses on the social context of behaviours and dynamics of situations in which behaviours occur. Action research, according to Maruyama, provides a versatile, potentially powerful approach for use in applied research on groups and group settings.

In the Netherlands, Bunders (1994) and Broerse (1998) developed research methods that focus on small-scale farmers (the interactive bottom-up method) to promote science-based innovations in biotechnology. These researchers focus in their work on the collaboration of scientists with non-scientist groups and develop strategies for the participation of these non-scientists in the research process.

A major question emerging from the above is what the effects are of user involvement on utilization and on research itself. Generally speaking, the effects noted in the literature on utilization are positive, the effects on research are contingent. A major problem, certainly in the context of developing nations, is that there are often many other factors interfering (like power structures with completely different goals) so that it is hard to assess what the effects are. The Sutherland *et al.* study mentioned above claims that the already precarious household food-security situation in semi-arid areas of Africa may be rendered more so through the implementation of structural adjustment programmes that frequently prescribe austerity measures, along with a safety net to protect the vulnerable. The authors, using a participatory agricultural research project in Eastern Kenya as a case study, describe specific household food-security problem diagnoses and a range of research interventions planned within a more sustainable rural livelihood framework. Working with local farmers, the project implemented a range of applied research and linked development interventions that showed promise in easing food-security through a broadening of the livelihood base. Some of these initiatives were carried further through the local farmers' own initiative. The conclusion of the article is that semi-arid areas, despite views that see these as low-potential and obvious safety-net candidates, often have potential for agricultural intensification and increased productivity.

To ensure that research results are utilized and farmers have access to new technology and markets, Sutherland *et al.* conclude that there is a need for external or public-sector support to integrate longer-term development initiatives. This may require rethinking the scope of research and development approaches, particularly removing unhelpful boundaries between research, extension and development functions, and increasing farmer participation in the whole process - if possible as part of a less centralized and more household-oriented approach to food-security policy and strategy.

4. Utilization in terms of three thematic lines

In this section, we discuss the content of the term 'utilization' along three lines found in the literature. First, we elaborate some recent *conceptual changes* with regard to the production of knowledge based on literature from the areas of science and technology studies (and also innovation studies), and of development studies. We will then briefly discuss the *policy implications* of these cognitive changes, particularly with regard to the issue of scientific knowledge used for the benefit of societal goals (agenda setting). Here we also draw from the political sciences. Finally, we will reflect on some of the *political ramifications* of these conceptual changes, such as the autonomy of science and normative issues (power, value-related and cultural differences).

Conceptual changes

In the science and technology studies literature, new conceptual lines are coming to the fore regarding the organization of knowledge production and utilization (Gibbons *et al.* 1994; Gibbons 1999). The 'old' adage that science operates in a relatively isolated social position, produces and validates 'reliable' knowledge, and communicates its discoveries to society through some kind of established transfer mechanism was abandoned by most scholars a while ago. But the more recent idea of science operating in a policy arena in which different actors interact (In 't Veld 2000) appears also to be giving way to yet another concept. In this, the dominating image of science and society is not that of a linear relationship, or of interest groups engaged in some kind of political struggle. It is that of a more or less transient team of experts coming together from different scientific, technical and socioeconomic disciplines, including users, and striving to achieve 'joint problem solving'. Knowledge, in this context, is seen as

something essentially transgressive, meaning both that it knows no boundaries and that it can come from different directions (not only science). Connected with this transition is a changing idea of what science and doing research essentially is. The image of an ivory tower in which the truth will be discovered has been left behind (though it might still be present in the heads of some people) and replaced by more relativist perspectives in which science is in the first place a method, not an answer to a question. Science, in this perspective, is part of a whole process through which society renews itself, the innovation process in a broad sense. In this process several key actors may be discerned (see Verkaik 1997), each bringing their own expertise, experience and wishes to the table. Science is only one of them. Consequently, the traditional esteem for science is diminishing and uncertainties are growing - on the side of both science and of policy/society. This new situation demands different organizational approaches, and different visions of science and utilization.

Another conceptual line most relevant to our topic, and related to the previous one, is the renewed attention for users in the research process. In industry, users have always been a key factor in the research process, as is well documented in the literature on innovation studies (see also above). More recently, there has been new interest among institutions like the European Commission for the role of users in the research process (Den Hertog 1996). Clearly, in development studies, this interest has emerged earlier through methodologically innovative research that aimed at including users (participatory research, action research).

What do these changes mean for research in the context of developing countries? The transfer of scientific knowledge into practical use for development problems is arguably a more complex process than in industrialized societies (Boer and Box 1994). The development of scientific knowledge is still largely a 'Northern' business (cf. the very low number of Southern contributions in refereed international journals, Garfield 1983). Science is not well tailored to demands from the South, developing countries very often have a low absorption capacity, they suffer from the brain drain, etc. (see for example the inventory of the Dutch Ministry of Foreign Affairs in Boer 1991, reported also in Boer and Box 1994).

Furthermore, researchers in the South appear sometimes to be more interested in connecting to Northern research than in Southern problems, and as far as they are not, they encounter a host of problems building indigenous scientific communities (Schwartzman 1978, Vessuri 1997). This is partly due to the fact that institutional development in the South seems to reproduce Northern structures. Shenhav and Kamens (1991) describe the mechanisms through which science in non-Western countries is institutionalized to follow the forms that are prevalent in the major industrial nations. In the empirical section of their article, which is based on a sample of 73 less developed countries (LDCs) and underdeveloped countries (UDCs), the authors demonstrate that their findings are inconsistent with predictions made by theories of economic development and modernization. These theories predict a positive relationship between the degree of institutionalization and economic performance but, for LDCs, no such relationship was found; for the UDCs, it was even negative. Thus, Shenhav and Kamens conclude that institutional isomorphism and conformity to external rational myths are only loosely related to internal economic efficiency. Because of this manifold North-South imbalance, several types of research have developed that aim at involving more local knowledge and expertise in both North and South (cf. Lammerink 1993).

Policy implications

Utilization of knowledge has an important function in the formulation of government policy. Most policy issues of some weight depend on some form of research or scientific information and/or expertise. One reason, traditionally, is that scientific knowledge is found to be 'reliable', and therefore to offer legitimate support for policy solutions. But the reliability of science has become questionable over the last decades. Policy-makers and scientists alike have begun to learn that 'uncertainty is intrinsic [to science] and that they can no longer hide behind a confident belief in science and its claims to provide the objective truth' (Ziegler 2000). The close links between science, technology and politics in some sectors (such as environmental policy) have been challenged lately, and the challenge is aimed precisely at the traditional strength of science - its reliability. The Dutch National Institute for Public Health and the Environment (RIVM), for example, has been accused of losing its reliability and 'objectivity' by writing reports that imply a certain policy direction. Other mechanisms are at work in the science-technology-policy network. The scientific bodies set up in the 1980s to advise

governments on climate change policy, which emerged from the globally coordinated research community, have been accused of acting primarily as a lobby for their own research agendas dedicated to the modelling of the planet and the development of alternative energy sources. By way of illustration, the advice of the Intergovernmental Panel on Climate Change (IPCC) was necessarily ambivalent and too weak to initiate an active global environmental policy (Boehmer-Christiansen 1994). International negotiations resulted in a research-intensive international treaty reflecting scientific uncertainty rather than environmental precaution. The primary interest of research, according to these authors, is the creation of concern in order to demonstrate policy relevance and attract funding. Policy relevance and, therefore, the need for scientific advice, decline rapidly once a problem is actually dealt with by regulatory, technological or behavioural change.

On a different level, science and technology may be used to increase welfare in a society, to enhance security, or reduce suffering, hunger etc. ('science for public policy'). In industrialized societies, science and technology may be held accountable for higher living standards. In many developing countries, however, this is still questionable. A quick random comparison of key issues found in the literature between developing and developed countries produces the following for the former: poverty, illiteracy, malnutrition, prostitution, substance abuse, family disruption, lack of child care, high rates of maternal and infant mortality, the patterns of utilization of health services. Industrialized societies are faced with different problems, for example: the isolation of the nuclear family, economic pressure for mothers to work, deficiency of childcare facilities, ambiguity in the definition of parental roles, marital instability and impersonal, medicalized health care. These results provide the basis for culturally-sensitive suggestions to improve utilization in areas such as social welfare schemes, health prevention and treatment programmes.

Increasing welfare is one of the oldest missions and justifications of science. When 'policy for science' became dominant in public policy, however, science was separated from societal values and committed to context-independent conceptions of truth. Policy was to provide the conditions under which science could flourish and come up with 'objective' solutions for social problems, a process that Stephen Marglin has called the 'implicit privileging of scientific objectivity' (1990: 11). But the relations between science and public policy have changed considerably in recent years. To begin with, policy-makers have been confronted with public debates between scientific experts, a phenomenon not uncommon in science, but new in the broader arena of social debate. Policy-makers dealing with important problems in areas such as the health sector or the environment have continued to look to science for knowledge that might form the basis for political action. But how should they proceed when the experts contradict each other, or provide answers that are complicated by the fact that they work in multi- and interdisciplinary teams, and have difficulties in formulating problems and finding ways to cooperate on coherent questions? Policy-makers have been increasingly confronted with the necessity of making 'hard' decisions in the face of 'soft' scientific evidence.

Political ramifications

The increasing vagueness of the boundaries between science, policy and society at large also has a number of political consequences. Is science losing power, is the user gaining impact? And is utilization thus improved? To say that knowledge is power is to enunciate a compelling metaphor, but one that might not be true for science. According to the president of the Netherlands Academy of Sciences in a recent interview, politicians do not think much of science. He argued that, even in an affluent situation, the scientific community has to struggle for attention (and money). Many politicians seem not to see research as something useful, at least in the Netherlands. For the president of the Academy, this indicates that science and scientists have an image problem. That might be true, but it is not the whole story. First, there is the general problem that science and technology offer a lot of good things for humanity, but at the same time have their dark side (Newby 1992). And, perhaps, politicians have reason to believe that the efficacy of research is still relatively low. The disappearing boundaries between science and policy, the increasing commercial influences on scientific institutions, and the increasing demand from funding agencies that research have societal relevance, are all more likely to elicit the reaction from researchers that scientific autonomy is in jeopardy than that research needs to be effective. Perhaps this is because scientific credibility is still largely believed to depend on judgmental impartiality (the Mertonian research ethos). Evaluation schemes that can handle the new

situation in which science develops as part of a larger innovation process, are not yet common (see next section). There is however another reaction possible, as was shown at a large international conference in Zürich in February of this year (IT 2000 Conference). Researchers at the conference explicitly sought cooperation with users to improve the relevance and utilization of their research.

'Misuse'

The underlying assumption held by many still seems to be that scientific fact and political values should be clearly distinguished from each other. If science is affected by other values it loses its critical function. Köbben & Tromp recently initiated much controversy on this issue with their book *De onwelkome boodschap* (The Unwelcome Message) (1999). In the book they analyse how the relationship between those who pay and those who research can direct research in the direction of policy demands. They accuse research institutions of sometimes being docile in relation to the contractors of research, in the findings and recommendations of their research, and in expert advice on policy proposals. 'Wie betaalt, bepaalt' (89 ff.; meaning whoever pays is in the driving seat) became a much discussed issue. In a major US study, Steneck evaluates the problem of misconduct in scinece (Steneck 1999). In 1985, after nearly a decade of inconclusive professional response to public concern about misconduct in research, Congress passed legislation requiring action. Subsequent to this legislation, federal agencies and research universities adopted policies for responding to allegations of misconduct in research. New educational initiatives were begun which included ethics instruction in training grants. The study evaluates the change since 1985 from the perspective of three key goals: 1) confronting misconduct, 2) promoting integrity and 3) ensuring integrity. While significant progress has been made in achieving the first two goals, the third remains largely unaddressed. This is due to the fact that researchers have not been interested in studying the integrity of their own profession. There are many well documented instances of scientific experts taking part in opposing sides of controversies in which they served as advisors (Weingart 1999: 156).

More scientific freedom does not necessarily generate more reliable knowledge or results. Knowledge is intrinsically related to values; scientific knowledge can be used to legitimize different political positions and decisions. Ensuring democratic access to scientific knowledge seems a better solution than improving the freedom of science. The danger of machinations with scientific results is limited also by the fact that, in the political arena, the results of scientific research are not only tested for their scientific credibility but also for social robustness (Gibbons 1999). In a transparent society, this process should provide enough checks and balances. Gibbons (1999) concludes: 'For reliable knowledge can only become socially robust if society sees the process of knowledge production as transparent and participative'. Gibbons' paper is a plea to rethink science in this direction and a warning against the obsolete image of neutral science behind 'closed laboratory walls'. Science should be in the public arena. Science, says Gibbons, is now in need of a new legitimation in the form of a new social contract between science and society, a contract that must ensure that scientific knowledge is produced in a transparent and participative way.

5. Emerging issues relevant for utilization

A number of issues are emerging in the recent literature that are relevant for the research process as a whole, and thus for utilization. In this section, we review three of these. First and foremost is the rise of what is now commonly referred to as information and communication technology (ICT), or the 'digital' or 'information' revolution. It is expected to have a massive influence on society as a whole, and thus also on research. Second, and connected with the emergence of ICT, is a renewed interest in an area called 'knowledge management'. The growing availability of data, thanks especially to the internet, calls for specialists to control this new information flow. Third, new forms of evaluation are emerging that aim to include the policy or societal context in the assessment of research.

The influence of ICT on research and utilization

The new information technologies now inundating the planet are bound to transform the world's economy (arguably, we are now witnessing the rise of a 'new' economy) and therefore its social and cultural life. ICT is being applied in all sectors, not only in traditional areas of information (newspapers, books, broadcasting), but also in retail, banking, the peace movement and by individual consumers. Living without a homepage is almost like living in anonymity - at least, in the North.

In science, ICT has started to change the research process itself. Huge amounts of data are available on a scale that never existed before, and are accessible nearly everywhere in the world. ICT has also the ability to make research more accessible for policy-making and for societal/private sector applications and utilization. In the USA, it is now common for private companies and government organizations to develop user-networks to support their core business. SUN Microsystems, for example, has set up a system in which a variety of 'interest groups' are involved in the early stages of product development (introducing 'marketing' in the early research phase). Later, when products are nearing market readiness, 'power users' are involved to fine-tune them. Another example of close cooperation with users is the way ISI (the owner of the citation indexes) launched its 'user-friendly' interface, the Web of Science. This interface offers researchers desktop access to the ISI databases, which contain some 8,000 of the world's top journals. To promote and maintain its user-friendliness, ISI formed a special committee bringing together the publisher, the service provider, the negotiator, and representatives of the user community. Other publishers are developing similar tools. Clearly, the goal of these commercial companies is to conquer a larger share of the market. At the same time, users (in this case the researchers) may profit from greater information facilities.

Most countries in the developing world lag behind in these areas, as is unfortunately the case in many of the more traditional information sources[9]. ICT development might, however, offer them the chance to make a 'giant leap'. Scientific journals, for example, are much easier to access in digital format than in hard copy. Once an internet connection is established, a wealth of resources can be made accessible. It is relatively cheap, compared with buying and shipping books or journals. Of course, you need good and fast computers, servers and cable networks (perhaps replaced by satellites in the near future). But building and maintaining a reliable infrastructure is one thing; keeping up with the speedy development of technology in this area is still rather demanding and costly. In *Bridge Builders: African Experiences With Information and Communication Technology* (Office of International Affairs, National Research Council, 1996), sixteen remarkable stories offer first person accounts of how information and communication technologies have been successfully introduced into institutions for the benefit of scientists and engineers in sub-Saharan Africa. These case studies focus on the lessons learned in designing and implementing projects dealing with scientific and technological information and examine the impact.

The role of knowledge management in utilization
'The good news is that there is a great and largely unexploited potential for increased production of food in Africa. *Much relevant research is also on the shelf* (our italics), but needs to be complemented with research that addresses real farmer problems. The typical African farmer is no longer a 40-year-old male, but a 13-year-old girl trying to keep a family together that is falling apart for reasons of disease, including AIDS, and social and military unrest. Most agricultural research has failed to notice it. This must change.'

This excerpt from one of the RAWOO lunch lectures (by Stein Bie; reproduced in this volume) indicates what knowledge management can mean in certain situations in developing nations. For developing countries, a lot of knowledge is on the shelf, simply because they do not have access to it. A knowledge manager, and ICT, might help change that situation.

Knowledge management is receiving increasing attention in the literature. Some authors focus on the role of government (Frissen 1996), others on the role of knowledge management in research and innovation processes, particularly in industry where it is seen as one of the key elements in gaining competitive advantage (Edmunds and Morris 2000). Discussion about knowledge management typically has an internal and an external component (Coombs and Hull 1998). The internal component regards the ways in which routines are arranged inside an organization to 'stabilize certain bodies of knowledge, embed them in the shared understandings within the firm, and provide templates for deploying that knowledge to produce innovations which have a distinctive organizational 'signature'.' (Coombs and Hull 1998: 238). The external component derives from the perceived increase in the importance of knowledge as a production factor and as a driving force in broader changes in the nature of contemporary economies, and in the enterprises that operate in those economies.

At a recent conference in The Hague on public knowledge management (*Publiek kennismanagement*, December 1999; for information see: www.science-alliance.nl) the conclusion was that knowledge management was an under-

9. There are also success stories here. The *Financial Times* of 3 June 2000 noted that 185 of the so-called Fortune 500 companies outsourced their software requirements to India, and not only for the cost benefit but also because of their qualitative edge.

developed area in public policy. In particular, government appears to lag behind in the area of ICT-related knowledge management development. ICT can contribute to the efficiency of data collection, expertise and know-how. Doubts were expressed that government has a good overview of what is produced in its own knowledge institutes, which makes knowledge-intensive policy-making difficult.

There is now increasing collaboration between government and private knowledge managers, and also between different ministries. The hope is that this can lead to a much wider insight, but also to a better service to the public (the user of policy measures). All kinds of new forms of interaction between government and people are foreseen, for example, smart cards, electronic debating, voting, taxing, etc. In the abstract, it is possible to involve the public directly in policy development. This would again change the meaning of 'utilization'. It seems necessary (and wise) that government develops a coherent policy in this area. Frissen (1996) gives a critical analysis of the role of government in his book about the 'virtual state'. According to Frissen, the digital revolution will fundamentally change democratic processes, but the role of government should not be to control this development, but to guarantee public access. The public space will be defined more and more by the new information and communication structure that is now emerging. This includes - most relevant for our topic - how data are stored, and how databases are linked and made accessible. Frissen sees a future where everybody can be his own research centre or planning agency. He believes that electronic polls will give a better view of what people want than democratic elections.

Knowledge managers need to combine a broad knowledge of ICT and a view on these wider developments. Of course, there are darker sides here too, in particular with regard to the confidentiality of data, and their reliability. Knowledge and information can be manipulated - perhaps more easily than before - or the sheer abundance of knowledge available might simply be too overwhelming. The number of experts who can address a certain topic is unlimited, as is the potential number of different opinions. This is the paradox of public knowledge.

Context-oriented research evaluation

An extensive review and synthesis of literature on the use of evaluations published since 1986 observes several recent developments in theory, research and practice (Shulha and Cousins 1997). These developments coincide with the changes in the knowledge production process described above. They include the rise of considerations of context as critical to understanding and explaining use, identification of process use as a significant consequence of evaluation activity, expansion of conceptions of use from the individual to the organizational level, and diversification of the role of the evaluator to facilitator, planner and educator/trainer. In addition, understanding misuse has emerged as a significant focus for theory and, to a limited extent, research.

Jones *et al.* (1999), discussing the interface between scientific research and policymaking institutions in the area of climate change, have proposed an evaluation method that may be generally applicable. The method considers the adequacy of institutional structures for incorporating research, and research for addressing institutional needs. It involves interviews (with policy-makers and scientists) and formal analyses of the links between the research and the decisions described in the interviews. It shows these policy-makers to be receptive to research, which is, in principle, relevant to them. However, they are unable to use it because the research is not formulated in ways compatible with current decision-making models. For their part, these decision-making models are not comprehensive enough to capture the full range of potentially relevant environmental forces, including climate change.

'Use of evaluation' once meant the use of results for making programme decisions (Weiss 1998). Now we are aware of its larger dimensions. Many aspects of evaluation can be used - ideas and insights, signals that are sent by the very fact of evaluating, the processes of learning through cooperation with evaluation, the choice of outcome indicators that herald success, even the study design. 'Use' encompasses a broad array of effects by multiple classes of users. Weiss' article highlights the importance of considering further potential collective users: the programme organization, client groups and civil society.

Wallerstein (1999) notices that the relationship between evaluators and communities has been changing in the last two decades to a model of research 'with' the community, instead of research 'on' the community. This shift has paralleled

increasing community demands for accountability and authority as community participation rhetoric has brought us words such as partnership, collaboration and community empowerment. Despite the rhetoric, there has been little reflection on the problematic and contradictory relationships between communities and researchers, specifically as related to their differing positions of power. Wallerstein provides a reflective examination of the contested power dynamics of the research relationship within a participatory evaluation process of the Healthier Communities initiative in New Mexico. An in-depth literature review of the philosophical principles and the complex realities of evaluations based on participatory, community-driven and post-modern inquiry precedes the case study. The article argues that, without ongoing consideration of power issues, the design and the implementation of the evaluation, and the utilization of its findings will be compromised.

In evaluation practice, the context of research is becoming an integral part of the considerations. That is, use and utilization are becoming part of the evaluative method. Developments here are still in the early stages, in particular with respect to two types of questions. One is how to weigh the different aspects of the research process (traditional scientific quality versus new context-oriented aspects). The other is of a more technical nature: how to validate the different measuring methods, how robust can they be? (See Spaapen and Wamelink 1999). As far as measuring the scientific quality of research is concerned, a whole separate field of research has emerged in recent decades: bibliometrics and scientometrics. In this field, a wide range of issues are discussed extensively, including validation and robustness. A comparable forum does not yet exist for the measurement of other, context-oriented aspects of quality. In fact, a more or less coherent forum to discuss research in the context of society in broader terms than just the measurement of quality, has not yet been developed.

6. Conclusions and ways forward

In this concluding section, we will summarize how the concept of 'utilization of research' has changed and which lessons can be learned by policy-makers when considering improving utilization in the context of research and innovation policy.

Long and Villareal (1993) remind us that, in 1969, Havelock suggested that the essence of knowledge utilization is the linkage between two social systems, one of which is faced with a problem and the other with delineating options that facilitate resolution. In 1999, Gibbons writes: 'Under the prevailing contract (between science and society), science was left to make discoveries and then make them available to society. A new contract will be based upon the joint production of knowledge by society and science.'

Utilization of scientific knowledge has been a topic of growing interest over the last 20 years. It is part of a long standing discussion concerning the relation between science and society, but the distinctive characteristic of the current debate is that it takes place in a different context than a couple of decades ago. After the so-called 'relativistic turn' in the sociology of science, the scientific enterprise is looked upon rather differently. Scientific research appears to be undergoing rapid yet fundamental change exemplified by the emergence of new forms of research organization (Wilts 2000). This change has been alternately described as the advent of 'post-normal science', characterized by a new and value-sensitive methodology (Funtowicz and Ravetz, 1990), as 'the new production of knowledge', replacing conventional forms of research organization (Gibbons *et al*., 1994), and as the emergence of a 'triple helix' of intricate relations between university, industry and government (Etzkowitz and Leydesdorff, 1997). These notions differ in terms of their particular conceptual definitions and assumptions, but share an orientation towards innovative and application-oriented research in the interface between scientific, economic and political domains.

At the same time, a broader process of societal change can be observed. Manuel Castells, in his major three-volume work 'The Information age: economy, society and culture', observes the most important events that transformed society towards the end of the twentieth century. These are a technological revolution centred around information and communication technologies (ICT) and a process of globalization in which economies throughout the world have become interdependent. Both developments have a profound influence on the relationship between the economy, the state and society at large. They also affect the relationship between individual people and the surrounding society. On the one hand, the options for people to 'develop' seem to have become boundless, while on the other hand, mass production (of food, for example, or of 'health') consisting of countless

links all over the world - which are therefore hard to control - is creating a 'risk society'. In order to assess these risks, more precise and accountable (in Gibbons words, 'socially robust') information is needed about the different steps in these production processes and, for example, the role of scientific and technological aspects. Society has become more assertive, particularly in the industrial countries. As society 'speaks back', as Gibbons puts it, the esteem of science seems to diminish. Firstly, competing views from the scientific community become public, and are publicly discussed (cf. the present debate about global warming or genetically manipulated food); second, scientific views increasingly have to compete with non-scientific knowledge and expertises. The relationship between science and society is no longer linear but iterative, and consists of a complex network of interacting 'stakeholders'. Scientific research and utilization have both become part of a broader process, the innovation process (see Verkaik 1997, who distinguishes seven stakeholders in the innovation process).

Empirical findings in the area of 'science and technology studies' have affected vested ideas about the very nature of the process of knowledge production, its validation, diffusion and utilization. Theories dominated by the linearity of the innovation process (innovation in the sense of technological and socioeconomic development) have been replaced by interaction - and by network models, learning processes and evolutionary developments. Through the changing patterns of interaction between science, policy, industry and society at large, the issue of utilization is receiving new attention. The actual 'blurring of institutional boundaries' sheds new light on the position of each actor and on some of the 'old' dilemmas that occur between science and society: the differences in norms, values, interests and expectations between science, policy, industry and society. A recent example is the discussion about the relative autonomy of science in the context of a growing dependency on state contracts, known in the Netherlands as the 'third money flow' (Köbben and Tromp, 1999).

These complex relationships in the broader process of innovation come to the fore particularly in the literature dealing with the industrial societies, which have become increasingly dependent on scientific and technological development. But, while the role of scientific knowledge production in the formulation and the implementation of policy is subject to comprehensive investigations in the North, it has not yet been investigated extensively with regard to the South (but see Shinn *et al.*1997). Evidence on the impact of scientifically planned interventions shows ambiguous results. Studies about 'knowledge transfer' to developing countries confront us with an array of problems, often related to the skewed power relationship between the North and the South. More specifically, linear models of 'planned intervention' are heavily criticized in the light of detailed studies of field experiences (e.g. Lall 1992, Long and Villareal 1993, Platt and Wilson 1999).

From the existing literature we may conclude that the relations between science and society, between research and policy, are increasingly interwoven, intricate and complex. Efforts aimed at improving utilization require a more thorough understanding of this complex relationship. In this, a different perspective is needed on research vis-à-vis society than a couple of decades ago. In short, the relationship should be seen as more dynamic and less linear. Also required are more empirical (descriptive) studies about the intricacies of the utilization process and about the roles of the various stakeholders (including the end-users). This review of the literature did not find many such studies. Perhaps there is more to be found in the so-called grey literature, but to explore this would be extremely time consuming. In the existing literature use and utilization are still mainly discussed as rather static elements in the interaction between research and innovation and/or between research and policy.

Policies that aim at improving utilization are contingent on the model that is chosen by the policy-maker. There are three different models for approaching the complex interaction processes related to the utilization process, with different implications for policy use.

1. The Management model: the present-day problems of society, such as environmental concerns, food and water insecurities, uncertain consequences of new technologies, etc., are addressed with a managerial approach to science policy. This model assumes a high degree of control and is closely related to systems thinking. The relation between science and policy, and utilization is controlled by scientific managers.
2. The Public Arena model: debates about science and technology are conducted publicly,

between a variety of stakeholders. Science is socially constructed and negotiated. This interactive model of science and society is an explicit denial of the linear model behind the first model. Science and society are jointly involved in the problem definition itself (climate problem, environmental protection). Science is only one actor among many in the political system and participates in setting the political agenda. Policy may act as facilitator.

3. The Transdisciplinarity model: this model takes the previous model one step further. Different stakeholders form heterogeneous and more or less transient groups that jointly work on a problem. Mutual learning and social experiments are central in the selection of socially robust knowledge. The emphasis in this model is on research in an applied context. Innovation is seen as the result of many interactions between partly overlapping social domains (Spaapen and Wamelink, 1999). These domains are generally a mix of technical and non-technical elements. Policy may act as part of the team.

We realize that we have made the picture of research utilization more complex by discussing it as an integral part of the innovation process as a whole. Notwithstanding that complexity, and perhaps somewhat independent of the models described above, we will conclude with some more general notions with regard to the question of how to improve research utilization. We do that without discussion, because we think that the most important lesson for policy lies in the recognition of the complex interaction process that underpins innovation, and thus utilization. Following this argument, utilization of research will be raised by:

- early involvement of stakeholders. A stakeholder analysis in which different user groups and their interests are identified would seem pivotal (cf. Spaapen and Wamelink 1999);
- collaboration between stakeholders (joint projects, publications). Learning processes are important here;
- recognition of potential conflict between different aggregation levels (national policy versus local interests);
- 'empowerment of absorptive capacity' in society (capacity building, education, research). Civil society needs to have a countervailing power vis-à-vis research related power;
- the training and education of researchers. Researchers need to understand that their research is only part of the solution of a problem, that, in order to solve issues, they have to cooperate not only with other disciplines but also with non-scientists;
- ICT development. Potentially, developing countries will benefit when technology becomes more accessible and cheaper. Since some developing countries already benefit more than others, it is pivotal to have a better understanding of the role of ICT in these processes;
- knowledge management. This concerns both knowledge that is 'on the shelf' and 'new' knowledge;
- user-oriented evaluation. For utilization to mean anything, it must be connected with users. Therefore, the links between research, policy and users should be part of any evaluation procedure.

Literature

- Apffel-Marglin, F. and S. A. Marglin (eds.), *Dominating Knowledge. Development, Culture, and Resistance*, Oxford University Press, Oxford, 1990
- Argyris, Ch. and D. Schön, *Theory in Practice: Increasing Professional Effectiveness*, Jossey Bass, San Francisco, 1974
- Argyris, Ch. and D. Schön, *Organizational Learning II, Theory, Method and Practice*, Adison Wesley Publishing Company, Reading, etc., 1996
- Ashby, J.A. and L. Sperling, 'Client-driven research and technology development in agriculture', *Development and Change*, Vol. 26, No. 4, 1995, pp 753-770
- Bell, M. and M. Albu, 'Knowledge systems and technological dynamism in industrial clusters in developing countries, *World Development*, Vol. 27, No. 9, September 1999, pp 1715-1734
- Blume, S.S., *The Development of Dutch Science Policy in International Perspective, 1965-1985*, Background study No. 14, RAWB, The Hague, 1986
- Boehmer-Christiansen, S., 'Global climate protection policy the limits of scientific advice', *Global Environmental Change - Human and Policy Dimensions,* Vol. 4, No. 3, 1994, pp 185200
- Boer, L. (ed.), *Onderzoek en Beleid in de Nederlandse Ontwikkelingssamenwerking*, Ministerie van Buitenlandse Zaken, The Hague, 1991
- Boer, L. and L. Box, 'The tenuous interface: policy-makers, researchers and user-publics: the case of the Netherlands' development cooperation', *Knowledge and Policy*, Fall-Winter 1993-1994, Vol. 6, Nos. 3 and 4, pp 158-175
- Boogerd A, P. Groenewegen and M. Hisschemöller,

'Knowledge utilization in water management in the Netherlands related to desiccation', *Journal of the American Water Resources Association* Vol. 33, No. 4, 1997, pp 731740
- Broerse, J.E.W., *Towards a new development strategy: how to include small-scale farmers in the biotechnological innovation process*, Eburon Press, Delft, 1998
- Bulmer (ed.), *Social Science and Social Policy,* Allan & Unwin, London, 1986
- Bunders, J.F.G., *Participative Strategies for Science-Based Innovations: the Case of Biotechnology for Small-scale Farmers in Developing Countries*, VU University Press, Amsterdam, 1994
- Callon, M., 'The dynamics of techno-economic networks', in R. Coombs, P. Saiotti and V. Walsh (eds.), *Technological Change and Company Strategies*, Harcourt Brace, London, 1992
- Castells, M., *The Information Age: Economy, Society and Culture - Vol. I, The Rise of the Network Society*, Blackwell Publishers, Cambridge Ma., 1996
- Cockburn, I.M. and R.M. Henderson, 'Absorptive capacity, co-authoring behaviour, and the organization of research in drug discovery', *Journal of Industrial Economics*, Vol. 46, No. 2, 1998, pp 157-182
- Coombs, R. and R. Hull, 'Knowledge management practices and path-dependency in innovation', *Research Policy,* Vol. 27, No. 3, 1998, pp 237-253
- Cornwall, A. and R. Jewkes, 'What is participatory research?', *Social Science & Medicine*, Vol. 41, No. 12, 1998, pp 16671676
- Cozzens, S.E. and E.J. Woodhouse, 'Science, government, and the politics of knowledge', in Jasanoff *et al.* (eds.), *Handbook of Science and Technology Studies*, 1995, pp 533-553
- Davis, P. and P. Howden Chapman, 'Translating research findings into health policy', *Social Science & Medicine*, Vol. 43, No. 5, 1996, pp 865-872
- DGIS, 'Meeting of like-minded donors on societal direction and impact of development related research', two readers, Ministerie van Buitenlandse Zaken, The Hague, 1994
- Dits, H. and G. Berkhout, 'Towards a policy framework for the use of knowledge in innovation systems', *Journal of Technology Transfer*, Vol. 24, 1999, pp 211-221
- Dressman, M., 'On the use and misuse of research evidence: decoding two states' reading initiatives', *Reading Research Quarterly,* Vol. 34, No. 3, 1999, pp 258285
- Edmunds, A. and A. Morris, 'The problem of information overload in business organizations: a review of the literature', *International Journal of Information Management*, Vol. 20, No. 1, February 2000, pp 17-28
- Etzkowitz, H. *et al.*, 'The dynamics of innovation: from national systems and "Mode 2" to a triple helix of university-industry-government relations', *Research Policy,* Vol. 29, 2000, pp 109-123
- Freeman, C., *The Economics of Industrial Innovation*, Penguin, Harmondsworth, UK, 1974
- Freeman, C., 'Networks of innovators: a synthesis of research issues', *Research Policy*, Vol. 20, 1991, pp 499-514
- Fischer, F., *Evaluating Public Policy*, Nelson-Hall, Chicago, 1995
- Frissen, P.H.A., *De virtuele staat: politiek, bestuur, technologie: een postmodern verhaal*, Academic Service, Economie en Bedrijfskunde, Schoonhoven, 1996
- Funtowicz, S. and J. Ravetz, *Global environmental science and the emergence of second-order science*, EUR 12803EN, Ispra, Italy, 1990
- Ganuza, E., 'International cooperation: a Latin American perspective', in Schweigman and Bosma (eds.), *Research and Development Cooperation: the Role of the Netherlands*, 1990
- Garfield, E., 'Mapping science in the Third World', *Science and Public Policy*, Vol. 10, No. 3, 1983, pp 112-127
- Gibbons, M, C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M. Trow, *The New Production of Knowledge: the Dynamics of Science and Research in Contemporary Societies*, Sage, London, 1994
- Gibbons, M., 'Science's new contract with society', *Nature*, Vol. 402, supp, 2 December 1999, C81-C84
- Gichuki, F.N., 'Threats and opportunities for mountain area development in Kenya', *AMBIO*, Vol. 28. No. 5, 1999, pp 430435
- Green, K., R. Hull, A. McMeekin and V. Walsh, 'The construction of the technoeconomic: networks vs. paradigms', *Research Policy*, Vol. 28, No. 7, September 1999, pp 777-792
- Harding, S., 'Is modern science an ethnoscience? Rethinking epistemological assumptions', in Shinn, Spaapen and Krishna (eds.), *Science and Technology in a Developing World,* 1997
- Hargreaves, A., 'Blurring the boundaries between research, policy and practice', *Educational Evaluation and Policy Analysis*, Vol. 18, No. 2, 1996, pp 105-122
- Havelock, R.G., *Planning for Innovation through Dissemination and Utilization of Knowledge*, Institute of Social Research/Center for Research of Utilization of Scientific Knowledge, University of Michigan, 1969
- Hertog, P. den *et al.*, *User Involvement in RTD Concepts, Practices and Policy Lessons*, TNO/STB, Apeldoorn, 1996
- Hippel, E. von, 'The dominant role of users in the scientific instrumentation process', *Research Policy*, 1976, pp 212 –239
- Hisschemöller, M, P. Groenewegen, R Hoppe, C.J.H. Midden, *Kennisbenutting en politieke keuze: een dilemma voor het milieubeleid?*, Report IVM-VU Amsterdam, 1997
- Jasanoff, J., G.E. Markle, J.C. Petersen and Trevor Pinch, *Handbook of Science & Technology Studies*, Sage, London etc., 1995

- In 't Veld, R.J. (ed.), *Willens en Wetens: de Rollen van Kennis over Milieu en Natuur in Beleidsprocessen*, Lemma, Utrecht, 2000
- In 't Veld, R.J. and A.J.M. Verhey, 'Willens en Wetens: over de verhouding tussen waarden, kennisproductie en kennisbenutting in het milieubeleid', in In 't Veld (ed.) *Willens en Wetens: de Rollen van Kennis over Milieu en Natuur in Beleidsprocessen*, 2000, pp 105-144
- IT 2000 Conference, Proceedings of the International Transdisciplinarity Conference 2000, *Transdisciplinarity: Joint Problem Solving among Science, Technology and Society*, Swiss Federal Institute of Technology, 27 February-1 March 2000, Zürich
- Johnson, B.L., 'The politics of researchinformation use in the education policy arena', *Educational Policy*, Vol. 13, No. 1, 1999, pp 2336
- Jones, S.A., B. Fischhoff and D. Lach, 'Evaluating the sciencepolicy interface for climate change research', *Climatic Change*, Vol. 43, No. 3, 1999, pp 581599
- Kajermo, K.N., G. Nordström, A. Krusebrant, H. Bjorvell, 'Barriers to and facilitators of research utilization, as perceived by a group of registered nurses', *Journal of Advanced Nursing*, Vol. 29, No. 4, 1998, pp 798-807
- Knorr-Cetina, K., 'Scientific communities or trans-epistemic arenas of research? A critic of quasi-economic models of research', *Social Studies of Science*, Vol. 12, 1982, pp 101-130
- Knott, J. and A. Wildavsky, 'If dissemination is the solution, what is the problem?' *Knowledge: Creation, Diffusion, Utilization* , Vol. 1, No. 4, 1980, pp 537-578
- Köbben, A.J.F. and H. Tromp, *De onwelkome boodschap, of hoe de vrijheid van wetenschap bedreigd wordt*, Mets, Amsterdam, 1999
- Lall, S., 'Technological capabilities and industrialization', *World Development*, Vol. 20, No. 2, 1992, pp 165-186
- Lall, S., 'Understanding technology development', *Development and Change*, Vol. 24, Sage, London, 1993
- Lammerink, M.P., *Participatief actieonderzoek met rijstboeren, steenbakkers en vissersvolk: ervaringen uit Latijns Amerika en Nederland*, dissertation, The Hague, 1993
- Landry, L., N. Amara and M. Lamari, 'Utilization of social science research knowledge in Canada', *Research Policy*, Vol. 30, No. 2, February 2001, pp 333-349
- Läpple, D. and E. Maan, *Onderzoek en beleid in de volkshuisvesting: op zoek naar een vruchtbare samenwerking tussen onderzoek en beleid,* VUGA, The Hague, 1984
- Lindblom, C.E. and D.K. Cohen, *Usable Knowledge: Social Science and Social Problem Solving*, Yale University Press, New Haven/London, 1979
- Lindblom, C.E., *The Policy-making Process*, Prentice-Hall, Englewood Cliffs, NJ, 1968
- Long, N and A. Long (eds.), *Battlefields of Knowledge: the Interlocking of Theory and Practice in Social Research and Development,* Routledge, London, 1992
- Long, N. and M. Villareal, 'Exploring development interfaces: from the transfer of knowledge to the transformation of meaning', in Schuurman (ed.) *Beyond the Impasse: New Directions in Development Theory*, pp 140-168, Zed Books, London, 1993
- Maruyama, G., 'Application and transformation of action research in educational research and practice', *Systems Practice*, Vol. 9, No. 1, 1996, pp 85101
- Marglin, S., 'Towards the decolonization of the mind', in Apffel-Marglin and Marglin (eds.), *Dominating Knowledge. Development, Culture, and Resistance*, 1990, pp 1-28
- Mayda, J., 'Policy R&D: toward a better bridge between knowledge and decision-making', *Science and Public Policy*, Vol. 26, No. 6, 1999, pp. 395-402
- Meulen, B. van der and A. Rip, 'Mediation in the Dutch science system', *Research Policy*, Vol. 27, No. 8, 1998, pp 757769
- Newby, H., 'One society, One Wissenschaft: a 21st Century vision', *Science and Public Policy*, Vol. 19, 1992, pp 7-14
- Nowotny, H., 'A New Branch of Science, Inc.' in Von Schomberg (ed.), *Science, Politics and Morality*, Kluwer Academic Press, Dordrecht, 1997
- Office of International Affairs, National Research Council, *Bridge Builders: African Experiences With Information and Communication Technology*, National Academy Press, Washington, D.C., 1996
- Platt, L. and G. Wilson, 'Technology development and the poor/marginalized: context, intervention and participation', *Technovation,* Vol. 19, Nos. 6-7, June 1999, pp 393-402
- Postman, N., *Technopoly,* Vintage Press, New York, 1993
- RAWOO, *Framework for a Ghanaian-Dutch Programme of Health Research for Development*, Publication No. 15, The Hague, 1998(a)
- RAWOO, *Framework for a Philippine-Dutch Programme of Biodiversity Research for Development*, Publication No. 17, The Hague, 1998(b)
- Rip, A., 'Introduction of a new technology: making use of recent insights from sociology and economics of technology', *Technology Analysis and Strategic Management*, Vol. 7, 1995, pp 417-431
- Royal Netherlands Academy of Arts and Sciences, 'Interactive North-South research for development, with special attention for Natural Resources Management', International Conference, 16 December 1999, Amsterdam
- Schot, J., 'Constructive technology assessment and technology dynamics: the case of clean technologies', *Science, Technology and Human Values*, Vol. 17, 1992, pp 36-56
- Schwartzmann, S., 'Struggling to be born: the scientific community in Brazil', *Minerva*, Vol. 16, No. 4, 1978, pp 545-80

- Schweigman C. and U.T. Bosma (eds.), *Research and Development Cooperation: the Role of the Netherlands*, Royal Tropical Institute, Amsterdam, 1990
- Schweigman C. and I.A. van der Werf (eds.), *Development-related Research Cooperation: a Second Look at the Role of the Netherlands*, Royal Tropical Institute, Amsterdam, 1994
- Shenhav, Y.A. and D.H. Kamens, 'The 'costs' of institutional isomorphism: science in non-Western countries', *Social Studies of Science*, Vol. 21, 1991, pp 527-545
- Shinn, T., J.B. Spaapen and V.V. Krishna (eds.), *Science and Technology in a Developing World,* Yearbook 1995 for the Sociology of the Sciences, Kluwer Academic Publishers, Dordrecht, 1997
- Shrum, W. and Y. Shenhav, 'Science and technology in less-developed countries', in Jasanoff *et al.* (eds.), *Handbook of Science and Technology Studies*, 1995, pp 627-651
- Shulha, L.M. and J.B. Cousins, 'Evaluation use: theory, research, and practice since 1986', *Evaluation Practice*, Vol. 18, No. 3, 1997, pp 195208
- Snow, C.P., *The Two Cultures and the Scientific Revolution*, Cambridge University Press, New York, 1959
- Spaapen, J.B., 'Research and policy for in the Netherlands: a radical turn to the South?', in Shinn, Spaapen and Krishna (eds.), *Science and Technology in a Developing World,* 1997
- Spaapen, J.B. and F. Wamelink, *The Evaluation of University Research: a Method for the Incorporation of Societal Value of Research*, COS/NRLO report 99/121, The Hague, 1999
- Steneck, N.H., 'Confronting misconduct in science in the 1980s and 1990s: what has and has not been accomplished?' *Science and Engineering Ethics,* Vol. 5, No. 2, 1999, pp 161176
- Sutherland, A.J., J.W. Irungu, J. Kang'ara, J. Muthamia, J. Ouma, 'Household food security in semiarid Africa: the contribution of participatory adaptive research and development to rural livelihoods in Eastern Kenya', *Food Policy,* Vol. 24, No. 4, 1999, pp 363390
- Tornquist, K.M. and S.A. Hoenack, 'Firm utilization of university scientific research', *Research in Higher Education*, Vol. 37, No. 5, 1996, pp 509-534
- Verkaik, A.P., *Uitdagingen en Concepten voor Toekomstig Landbouwkennisbeleid*, NRLO report 97/17, The Hague, 1997
- Vessuri, H., 'Science for the South in the South: exploring the role of local leadership as a catalyst of scientific development', in Shinn, Spaapen and Krishna (eds.), *Science and Technology in a Developing World,* 1997
- Waardenburg, J.G., 'Hoofdlijnen van het nieuwe onderzoeksbeleid van DGIS', in L. Boer (ed.), *Onderzoek en beleid in de Nederlandse Ontwikkelingssamenwerking*, 1991, pp 71-76
- Wallerstein, N., 'Power between evaluator and the community: research relationships within New Mexico's healthier communities', *Social Science and Medicine*, Vol. 49, No. 1, July 1999, pp 39-53
- Weingart, P., 'Scientific expertise and political accountability: paradoxes of science in politics', *Science and Public Policy*, Vol. 26, No. 3, June 1999, pp 151-161
- Weiss, C.H., 'The many meanings of research utilization', *Public Administrative Review*, Vol. 29, 1979, pp 426-431
- Weiss C.H., 'Have we learned anything new about the use of evaluation?', *American Journal of Evaluation*, Vol. 19, No. 1, 1998, pp 2133
- Weyden, I. van der and J. Ruitenberg, 'Het stakeholdersmodel: een voorbeeld van sturing van gezondheidsonderzoek', in *Tijdschrift voor Wetenschap, Technologie en Samenleving*, Vol. 8, No. 2, 2000, pp 44-49
- Wilts, A., 'Forms of research organization and their responsiveness to external goal setting', *Research Policy*, Vol. 29, No. 6, June 2000, pp 767-781
- Woolgar, S., 'Configuring the user', in J. Law (ed.), *A Sociology of Monsters: Essays on Power, Technology and Domination,* Routledge, London, 1991, pp 57-99
- World Bank, *Knowledge for Development*, World Development Report, 1998/99, Oxford University Press, Oxford etc., 1999
- Ziegler, H., 'Uncertainty and the scientific basis for decision-making', *ITPS*, No. 46, JRC, July 2000, pp 21-24

Appendix - Literature search

In our literature scan we limited ourselves in the search process. The time window for the basic scan was ten years, 1991-2000, although some references took us back a little farther. We searched all three ISI databases (SCI, SSCI and A&HCI) simultaneously using the Web of Science interface (a relative new facility from ISI). We used the search parameter 'UTILIZATION OR USE AND RESEARCH OR POLICY' and checked the hits for relevance to our topic through the abstracts. We then used the 'cited references' and the 'related records' tools of the ISI database to search further. Most articles that seemed relevant for our topic were found in a limited number of sectors, in particular health and medical research, education (especially higher education) and, to a lesser extent, environment and agriculture. Remarkably enough, the words USE and UTILIZATION do not show up very often in titles of articles, more so in the abstracts or references. In a number of these cases, 'use' or 'utilization' refer to categories not relevant for our review, for example to the use people make of certain services (health for example)

or products (commercial). Our provisional conclusion is that the number of studies in the scientific literature that specifically focus on research use or utilization appears to be limited. When we added DEVELOPMENT as a search category, the number of hits fell considerably. Apparently, the previous conclusion applies even more for that sector.

We used the articles collected during our first search as a basis to explore the literature a little deeper. Using the 'cited references' and 'related records' tools of the ISI databases we snowballed through the wider literature. We were thus able to broaden our selection substantially, but it also blurred the focus. This partly reflects the broadness of the topic (it is not bounded by any particular field), and arguably, it also reflects the fact that it is not easy to identify utilization as a separate subject. In our view, this also reflects a change in the way the research process is currently conceptualized: no longer as a unilinear process in which knowledge is transferred to practice ('utilization') through certain mechanisms, but as one element of a larger innovation process in an interactive network with different social actors (see the main text for a more detailed presentation of this conclusion).

The fact that the word 'utilization' is found as a keyword many times but not in the title of articles seems also to indicate that it is an issue that is perhaps more taken for granted as a necessity. Or, perhaps, it is considered more as a logical consequence of research than as something problematic.

In any event, we found many more studies that focus on utilization in so-called industrialized countries than in developing countries. This in itself is not surprising, because much more research from the North is published in the ISI journals than from the South. We have aimed to pick out those elements that might be helpful in the case of utilization of research in developing countries. We have to realize of course that the conditions in the North are different, but on the other hand, North and South increasingly have common problems (in addition to very different ones) which can be solved only if researchers and others cooperate.

RAWOO publications

Utilization of Research for Development Cooperation. Linking Knowledge Production to Development Policy and Practice. Publication no. 21. May 2001.

The Need for Research Concerning the Local Response to Globalization in Developing Countries. Publication no. 20. September 2000.

Mobilizing Knowledge for Post-Conflict Management and Development at the Local Level. Publication no. 19. May 2000.

Building bridges in research for development. Review of 1997 and 1998. May 1999.

Information & Communication Technology and Development. RAWOO lectures and seminar. Publication no. 18. August 1998.

Framework for a Philippine-Dutch Programme of Biodiversity Research for Development. Publication no. 17. March 1998.

Developing a Ghanaian-Dutch programme of health research for development. Results of a questionnaire to identify relevant expertise in the Netherlands and willingness to cooperate with Ghana. Publication no. 16. February 1998.

Framework for a Ghanaian-Dutch Programme of Health Research for Development. Publication no. 15. March 1998.

Internal conflicts, security and development. RAWOO lectures and seminar. Edited by Bas de Gaay Fortman and Marijke Veldhuis. Publication no. 14. May 1997.

Towards a European Science and Technology policy for development. Publication no. 13. November 1996.

Agenda 21. RAWOO/RMNO lectures on sustainable development. Edited by Frans Duijnhouwer and Marijke Veldhuis. Publication no. 12. July 1996.

Research capacity for sustainable development. Report of a field study in Ghana, Kenya and Kerala (India) conducted for RAWOO by Wesley Monroe Shrum, Jr. Publication no. 11. April 1996.

Supporting capacity building for research in the South. Recommendations for Dutch policy. Publication no. 10. December 1995.

Building up and strengthening research capacity in Southern countries. A study prepared for the RAWOO by Frits Wils. Publication no. 9. August 1995.

Good Governance. Rawoo Lunchlezingen 1993. Redactie: Oda van Cranenburgh en Marijke Veldhuis. Publication no. 8. September 1995. *(in Dutch).*

A medium-term perspective on research for development. Research needs and Dutch research capacity. Publication no. 7. June 1995.

Meerjarenperspectief op onderzoek voor ontwikkeling. Onderzoekbehoeften en Nederlandse onderzoekcapaciteit. Publication no. 6. November 1994. *(in Dutch).*

Development and strengthening of research capacity in developing countries. Conference on Donor Support, The Hague, The Netherlands 2-3 September 1993. Edited by Marijke Veldhuis. Publication no. 5. June 1994.

Cultuur en ontwikkeling. RAWOO Lunchlezingen 1992. Publication no. 4.Maart 1993. *(in Dutch).*

Advies inzake de organisatie van het onderzoeksbeleid in het kader van ontwikkelingssamenwerking. Publication no. 3. Augustus 1991. *(in Dutch).*

Criteria for assessing proposals for research in and for developing countries. Publication no. 2. August 1991.

Advies over de registratie van ontwikkelingsgericht onderzoek. Publication no. 1. January 1991. *(in Dutch).*

Solar Energy Research. Policy paper 3. July 1990.

Industrialisation in Developing Countries. Seminar report. Edited by A.P. Smits. September 1989.

Industrialisation in Developing Countries, priorities and conditions for research. General Recommendations 5. February 1989.

Sustainable Land Use in Developing Countries; perspectives on an integrated approach. Working paper 2. November 1988.

Food Security in Developing Countries. Seminar report. Edited by A.P. Smits. October 1986.

Towards Autonomy for Women; research and action to support development process. Working Paper 1. June 1986.

Food Security in Developing Countries, research needs and conditions. General Recommendations 4. January 1986.

International Dimensions of Development Problems. Seminar reports. Edited by H.J. Mastebroek. 1984.

Legal Aspects of International Dimensions of Development Problems; research needs and priorities. General Recommendations 3a. June 1984.

International Dimensions of Development Problems; research needs and priorities. General Recommendations 3. October 1983.

Energy for Survival. General Recommendations 2. January 1984 *(abridged English version)*.

Health and Illness in Developing Countries. General Recommendations 1. January 1984 *(abridged English version)*.