Research and Technology for Development (RTD) through a EU-ACP Policy Dialogue

Scientific background, Methodology, and Toolbox

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14 August 2001

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List of acronyms

ACP	African, Caribbean and Pacific States, signatories to the Lomé Convention
CGIAR	Consultative Group on International Agricultural Research
DCD	Development Co-operation Directorate of the OECD
DG	Directorate-General (of the European Commission)
EC	European Commission
ECDPM	European Centre for Development Policy Management
EU	European Union
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICT	Information and Communication Technology
IDRC	International Development Research Centre
IDS	International Development Studies (Sussex, UK
NGO	Non Governmental Organisation
RTD	Research and Technology for Development
R&D	Research and Development
SCOT	Social Construction of Technology
SPRU	Science Policy Research Unit
STS	Science, Technology and Society (Studies)
S&T	Science and Technology
ToR	Terms of Reference
UN	United Nations
UNCSTD	UN Commission for Science and Technology for Development
UNCTAD	UN Conference on Trade and Development
UNDP	UN Development Programme
UNESCO	UN Educational, Scientific, and Cultural Organisation
UNU	UN University
UNU-Intech	UN University Institute for New Technologies
WHO	World Health Organisation

1 Purpose and scope of this report

This report has a dual purpose. First, and most importantly, it has to function as a stand-alone contribution to the advancement of the role of research and technology for development. But, second, this report also offers the scientific rationale for and reflection on the set-up of the larger project within which this report was produced. [1]

This report is a revised and extended version of the report that was presented at the Legon Conference in Ghana in January 2001 (Wiebe E. Bijker, Leonards, & Wackers, *EU-ACP Policy Dialogue on Research and Technology for Development (RTD). Methodology for RTD Diagnostic Studies in ACP Countries*, 2000).[2]

The report—its theoretical analysis, its methodology and its toolbox—is primarily aimed at providing a generic *instrumentarium*. The report's primary purpose is not to make claims about the contents of development policies, science and technology policies, or research policies for development. The aim is, rather, to provide methodological guidelines that will strengthen the scientific quality of the process that *leads towards* such policies. Users of the toolbox will need to make the substantive choices as to the contents of RTD policies themselves, but are helped in making them in a scientifically sound way.

1.1 Scientific background

The scientific background for this project is discussed at two different levels. First I shall describe the current project in its scientific set-up. I will explicate how the various subprojects hang together and build on each other. This has resulted in some scientifically robust insights, rather than mere policy suggestions. Second, and forming the larger part of the scientific background chapter, I will introduce a specific theoretical perspective to study the issues of science and technology for developing countries. This perspective draws on two decades research of science, technology and society (STS). A review of the role of research and technology in developing countries, and of related science and technology policy, leads to a scientific rationale for a policy dialogue.

1.2 Methodology

The core of this report is a methodology for carrying out 'RTD diagnostic studies.' This methodology is built on the scientific grounding provided in the previous chapter. Such a RTD diagnostic study describes a specific country's state of affairs in research and technology policies for development. This methodology will not offer a recipe for doing such studies, but is a set of guidelines and boundary conditions for making such studies. An important reason to develop such guidelines is to help generate RTD diagnostic studies that—because of their common methodological base—can contribute to the creation of a new co-operation strategy for research and technology that is shared by developing countries and donor countries. Hence, this report focuses on RTD *policies* and not merely on the RTD *landscape*, however important that is too.

[1] The larger project is described in the research proposal (R. Engelhard & L. Box, 1999). All information about this project and its various subprojects can be found on the ThinkTank: http://www.oneworld.net/thinktank/rtd/index.html

[2] I thank Louk de la Rive Box and Rutger Egelhard for their helpful comments on the previous report.

1.3 Toolbox

Although this is a scientific report, it seeks to contribute practically to the solution of very urgent problems. The final chapter therefore presents a toolbox, which should help policy makers in developing countries, at the European Commission, and in donor countries to apply the ideas of this report in practice. A *caveat* is in order though: usage of the term “toolbox” should not obfuscate the principally difficult and expertise requiring nature of the endeavour. Using the toolbox is no substitute for using high level experts or for going through all stages of difficult scientific discussions and political decision making—but it does provide guidance though those discussions and choices. Nor is the toolbox making the problem any smaller—it may even make the problem larger because it unveils more aspects, but it also provides a coherent framework to deal with these many aspects.

2 Problem setting: towards a policy dialogue[3]

This report is part of a larger endeavour to stimulate a policy dialogue on RTD reforms between the European Commission, donor countries (including the EU Member States, Norway, and Switzerland), and the ACP countries. The long-term aim of the project is the development of a framework for a policy dialogue on RTD. In this policy dialogue, ACP countries should be enabled to address the major challenges and crucial issues related to reforming their national RTD policies and to strengthening their RTD capabilities—in partnership with the EC, EU Member States, Norway and Switzerland. In addition, this policy dialogue should create conditions that favour South-South research co-operation.

Many developing countries are actively involved in the process of defining the role of RTD in their socio-economic development efforts, all in their own way. Consequently, they are showing growing interest in strengthening their own RTD infrastructures and capabilities. This interest in RTD is new. In the 1970s and 1980s mainstream thinking has treated technology as a largely exogenous factor to the development process. Consequently, traditional policy models for socio-economic development have emphasised production capacity (labour, equipment and machinery) as the principal engine of economic growth. Today, 'new technologies'—such as biotechnology, biomedical technology, material science, energy and information and communication technologies (ICT)—have however been identified as means of promoting long-term structural change in societies.

Astounding advances are being made in the field of the 'new technologies'. With a few exceptions, these developments are taking place exclusively in industrialised Western countries. Driven by applications of these new technologies, profound societal changes are taking place in the North. To keep up with these changes, developing countries urgently require their own, *locally contextualised* applications of these new technologies from Western origins.[4] Such contextualisation requires a critical reflection on all aspects of the technology. These countries therefore see the need to strengthen their own indigenous RTD infrastructures and capabilities.

In this report, we want to extend this recognition of the structurally important role of technology for development to also include 'older' technologies. To recognise this key role of technology and science in constituting modern society has been a central idea in the field of Science, Technology, and Society Studies (STS; see below) on which we draw. The implication is that although present attention to RTD policy is spurred by the 'new technologies', we will take research and technology generally as our focus.

The role of research and technology in development processes is complex, not in the last place due to the difficulties in identifying the exact technological requirements of various sectors of a developing economy.[5] In a number of strategic policy studies,[6] the UN Commission for Science and Technology for Development (UNCSTD)—together

[3] This section is largely drawn from the original research proposal (R. Engelhard & L. Box, 1999).
[4] See Bell (1993)
[5] For a well written overview of science and technology policies in practice, see: Ogbu (1995).
[6] See reports by UNCSTD (1995), UNCSTD (1997); and also Mansell (1998).

with organisations and institutes such as UNESCO, UNU-INTECH, SAREC, IDRC and IDS/SPRU—has paved the road for a shift in thinking about technology in development processes. This change is now rapidly transforming the policies that guide decision making in both international organisations and donor agencies. For example, the World Bank has recently made 'knowledge' and 'access to new technologies' an all-embracing issue in its future policies.[7] And, in its 1999 Human Development Report, UNDP has emphasised the necessity for developing countries to strengthen their indigenous 'knowledge capacities' in order to become competitive in a 'globalising, knowledge-based economy'.[8]

With this shift in thinking, these and other international organisations have put knowledge as key to socio-economic development on the political agenda. However, for many years, successful NGO's in developing countries have already supported this notion and have integrated research and technology capabilities in their poverty eradication programmes,[9] in particular to generate locally contextualised knowledge. Though, while *individual* NGO leaders have often played important roles as policy advisors at national and international levels, governments of developing countries have been inadequate to build on the results of the work of their *organisations* (and of the national NGO and RTD communities as a whole), as they too often have perceived them as potential sources of political opposition.[10]

This perception of the RTD community has not been the only reason why strengthening national research and technological capabilities has received low political priority in the past decennia. Many developing countries are implementing structural adjustment programmes. The budget policies, on which these programmes are based, emphasise reductions in government spending, and budgets for research and technology programmes have not been spared. In addition, donors have adopted a policy of encouraging developing countries to find funds from private sector organisations for developing and sustaining their national research and technology capabilities. However, the private sector still needs to find its place to participate in this process.[11]

Against this complex backdrop of delicate political issues facing policy makers today, numerous developments are taking place in the RTD communities of many developing countries. The European Commission (EC), interested in promoting the strategic role of research and technology in ACP countries, has formulated a new policy for its support to such developments.[12] On 5 June 1997, the Development Council approved this new

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[7] See the report by the World Bank (1998).

[8] See the report by UNDP (1999).

[9] One of such successful NGOs is the BAIF Development Research Foundation (Pune, India), which started from a scientific appraisal of 'high tech' artificial insemination techniques to boost milk production on small farms. See also Engelhard (1989); and other publications available at IDRC.

[10] EC/DG VIII (1999) *Issues and Options for European Support to research and Technology Development (RTD) in Developing Countries, proposal for common actions*, paper prepared for the Informal RTD expert group of the Commission, Member States, Norway and Switzerland, by EC/DG VIII, Economic and Trade Co-operation, NT, Info Society and R&D, Brussels, 6 May 1999.

[11] An illustrating case of how difficult it is to acquire funding from private sector organisations is the Cassava Biotechnology Network (CBN) (see Engelhard (1999); the paper has been reviewed and made accessible on the Internet by *Nature* at http//helix.nature.com/wcs/a37.html).

[12] Com (97) 174 final *Scientific and Technological Research—a Strategic Part of the European Union's Development Co-operation with Developing Countries (* a communication from the commission to the Council and the European Parliament dated 25 April 1997).

RTD policy and adopted various recommendations on its implementation. Later, both the EU Parliament (on 9 March 1999[13]) and the ACP-EU Assembly (at its 28th Session in April 1999[14]) endorsed these new policy plans.

In this new policy plan, the EC has adopted two lines of action:

1 supporting policy reform and capacity building in RTD in ACP countries, with special attention to 'create a facilitating environment for science and higher education, including universities;' and
2 Strengthening research collaboration between the European scientific community and its partners in developing countries.[15]

In addition to these two lines of action, the European Parliament—supported by the ACP-EU Joint Assembly—has requested the Commission to establish 'a European Foundation for the long-term support of research (...) in developing countries with a view to improving knowledge on the environments, resources and societies of those countries.'[16]

Given these policy intentions and the diversity of the developments currently taking place in the RTD communities in many ACP countries, the Commission wishes to start a *policy dialogue* between the European Commission, the EU Member States, Norway and Switzerland and the ACP countries. This dialogue should focus on five principal challenges:[17]

1 the enormous task of *developing new national RTD policies* in ACP countries, to resolve the existing lack of research capacities, and to generate contextualised knowledge and technology applications—and thus to make the work of the RTD community more relevant to national needs;
2 the formulation of *strategies for supporting institutional reforms of RTD infrastructures* and for *strengthening national RTD capacities* in ACP countries;
3 the *intensification of scientific co-operation* at national, regional and international levels;
4 the identification of *innovative funding mechanisms* to develop and sustain appropriate RTD infrastructures in developing countries (and to solve the apparent stand-off between public donor agencies and private sector organisations in this area);
5 the better co-ordination of the EU's position in the relevant international fora (World Bank, UNESCO, UNCTAD, WHO, Consultative Group on International Agricultural Research (CGIAR), the Global Forum on Agricultural Research, etc.).

A great number of actors need to become involved in this policy dialogue on RTD reform in ACP countries. All of them represent constituencies with widely different

[13] Resolution A4-0089/99 on *RTD in development policy*, dated 9 March 1999
[14] Resolution ACP/EU 2749/99/fin on *the contribution of research and science- including ICTs—to sustainable development* dated 1 April 1999.
[15] Council Resolution on research and technological development in the context of the EU's development co-operation policy, point 8, dated 5 July 1997.
[16] Resolution A-0089/99, para 8, dated 10 dated 9 March 1999; and Resolution ACP/EU 2749/99/fin, para 8, dated 1 April 1999.
[17] Com (97) 174 final, ibid

responsibilities, policy agendas, and scientific and commercial interests. Among these actors are:

- the public authorities in ACP countries, who are in charge of (i) formulating and implementing national (and regional) RTD policies (including regulations of intellectual property rights, of (tele)communications, imp orts/exports of goods and services, etc.), and (ii) reforming and strengthening their national RTD infrastructures and capabilities, in both the public domain and the private sector.
- the EC and the donor agencies of the EU Member States, Norway and Switzerland who may wish to adjust their own positions on new ACP policies relating to RTD reform. In addition, they may wish to specify and attach conditions to their support—under the Cotenou Convention—to implement these new policies. In the spirit of strengt hening complementarity, the EC and the Member States may also wish to co-ordinate their mutual positions on new RTD policies of ACP governments, but to focus (as they often already do) on bilateral support to implementation programmes.
- the RTD communities (universities, research institutes and networks) in ACP countries, who should play an active role in (i) establishing priorities in RTD policies, (ii) developing sustainable sources of funding for their implementation, and (iii) promoting (innovative) forms of collaboration with universities, research institutes and private sector organisations within both their region and the EU Member States, Norway and Switzerland.
- the NGO's and (multinational) private sector organisations. The former are increasingly acting as conduit between producers and end-users of technology. The latter have taken a dominant position in research technology applications, in particular in the fields of new technologies, such as biotechnology, biomedical technology and ICT.

A constructive policy dialogue between actors representing such a wide variety of interest groups has proven to be difficult, and many lessons have already been learned. In a Communication to the European Council and Parliament on *Scientific and Technological Research—a Strategic Part of the European Union's Development Co-operation with Developing Countries* (dated 25 April 1997), [18] the EC lists some of these lessons as follows:

- the lack of policy frameworks for RTD in ACP countries that has muted the impact of dispersed, often excellent RTD work;
- the absence of articulated clear visions on the key role that RTD could play in supporting sustainable development among both European donors and most ACP governments;
- the rare involvement of technology end-users and NGO's in the choice of RTD priorities, with the result that RTD projects are often perceived as 'academic' and 'without obvious practical use';
- the need for adequate methodologies for promoting effective collaboration between RTD research institutes and private sector organisations in ACP countries; and
- the weak impact of North-South research co-operation on development due to (i) the frequent asymmetry in these partnerships, to the detriment of the partners in ACP countries; and (ii) the sole focus—imposed by European donors—on three areas (sustainable management of natural resources, agriculture and health) with the

[18] Com (97) 174 final, ibid. pp 110-116.

effective exclusion of others (such as educational technology, biotechnology, biomedical technology, energy technology, and ICT).

These lessons and the recognition that a large number of actors with widely different interests need to become actively involved have prompted the EC to formulate four principles that should guide the policy dialogue on RTD:[19]

1 *partnership* at both policy and operational levels, promoting conditions under which (i) developing countries can take ownership for jointly defined policy priorities and (ii) effective implementation of EU actions can be optimised;
2 *differentiation*, taking into account the diversity of needs in and co-operation arrangements between countries;
3 *integrated approach* to solving specific problems, requiring close liaison with—and intensive interdisciplinary collaboration between—the producers of scientific and contextualised knowledge (in universities and research institutes) and those involved in its transfer and end-use (Government service organisations, NGO's and various socio-economic groups of end-users); and
4 *mainstreaming* of RTD as an integral part of all development policies and programmes.

The aims and precise form of the envisioned policy dialogue are yet to be defined. The principles of partnership and differentiation ask for a further elaboration of concrete steps in full consultation with the partners involved. The larger project, of which this report forms a part, envisages an important role for RTD diagnostic country studies: studies that describe the RTD situation and potential of a country, with specific sensitivity to all issues that may enhance or hamper an open policy dialogue. A RTD diagnostic study and the open policy dialogue make no sense without each other—they form a tandem. A RTD diagnostic study is only worth the effort if it is followed by, or forms an integral part of, a well-targeted policy dialogue. Such a policy dialogue should be conducted on three levels: nationally among the various RTD stakeholders (RTD agenda setting), inter-regionally between neighbouring ACP countries (RTD collaboration), and internationally between ACP countries and donor countries (funding RTD reforms and capacity building). It is the aim of this report to strengthen the scientific base of the other half of the tandem—the RTD diagnostic studies.

[19] EC/DG VIII (1999) ibid.

3 Scientific background

3.1 This project as a scientific research endeavour

The larger project, of which this report is one subproject, consisted of five phases, which closely hung together (see table 1).[20] In the first phase a prototypical methodology for doing RTD diagnostic studies was developed (for an elaboration of the concept of "diagnostic RTD study, see below) on the basis of previous studies (see appendix 8 for a listing). In the second phase four "critical assessment studies" were carried out to test elements of this methodology (see appendix 9).

	Phase	Actors	Period	Result
1	Prototype development	University of Maastricht	April-June 2000	(Wiebe E. Bijker, Leonards, & Wackers, *Terms of Reference for Assessment Studies on RTD in Developing Countries*, 2000)
2	First test of the methodology	Researchers in Ghana, Senegal, Uganda, Vietnam	June-September 2000	(Aryeetey, 2000), (Cisse, 2000), (Tindimubona, 2000), (Ha, 2000)
3	Confrontation of methodology with test studies; confrontation of project's key ideas with scientific and political communities	All researchers; members of Informal Working Group on RTD, European Union; invited researchers and policy makers	November 2000 (Brussels EU) January 2001 (Accra, Ghana)	(ACP-EU, 2001)
4	Redrafting the methodology	University of Maastricht	March-May 2001	This document (Wiebe E. Bijker & Wackers), 2001)
5	Development of political action plan	Researchers, policy makers of ACP countries, EU, and Informal Working Group on RTD	June 2001 (Maastricht and Brussels)	

Table 1 Phases of the scientific research project

The first prototype for the methodology and the four critical assessment studies drew on four previous studies which had mapped the situation of research and technology in

[20] These five phases are slightly different from the ordering in the original project plan. I use these five phases, however, because it allows me to highlight the scientific structure of the project more clearly.

Ghana, the Dominican Republic, Uganda, and Vietnam four countries; these were mainly carried out in 1996-1998 and published in 1999 (see appendix). No separate critical assessment study was carried out in the Dominican Republic. An extra critical assessment study was done, however, in Senegal. This resulted in a five country experience base for the phases 3-5.

In the third phase of the project three confrontations were organised. First, the critical assessment studies were used to criticize and evaluate the methodology during a one-day workshop in Brussels. And second, also in Brussels, the central ideas of the project, including the prototype of the methodology and the country studies, were confronted with the policy makers of donor countries in the EU Informal Working Group on RTD. Finally, methodology and the experiences of the researchers in the five developing countries were discussed with a larger group of researchers and policy makers from ACP countries, EU member states, and the European Commission. This latter "confrontation" was scientifically and politically very productive, resulting in the "Legon Statement" (ACP-EU, 2001).

In the fourth phase the results of the various "confrontations" in the third phase were use the revise the methodology. The fifth phase is focused on strategies to implement the results in the future.

3.2 Science, technology and society studies

In Science, Technology, and Society (STS) Studies, the development of science and technology is investigated in its interaction with society.[21] Several findings are relevant for the purposes of this report.

One key result is the re-valuation of indigenous knowledge. Scientific knowledge has been shown to be a specific knowledge system like so many others. It does stand out for its specific characteristics, maintained through methodologies and checked by peer review. But these are social accomplishments, and neither *a priori* given nor epistemologically different from 'other indigenous knowledge systems'[22] such as Western science. Science has an enormous value and potential, but this value is context-specific. There are situations in which scientific knowledge is irrelevant, and other types of knowledge more appropriate. The lesson for this report is that we should approach RTD policy with an open mind as to the contributions from various knowledge systems—partly scientific, partly other.

When we zoom in on the process of scientific and technological work itself, a similar point can be made: scientific research and technological development are heterogeneous activities that do not have the purity that some philosophies of science have assumed in the past. Scientific knowledge is constructed in laboratories, on the land of small farmers, in the offices of funding agencies, at international conferences, and in editorial offices. It is not a matter of asking clever questions to Nature, which then shouts back a clear ''yes' or 'no'.[23] The lesson for this report is that thinking about research and science must go further than the illusion that a combination of methodology and

[21] For a comprehensive overview, see the *Handbook* by Jasanoff (1995).
[22] See Watson-Verran (1995).
[23] Two path-breaking studies are Latour (1979 (1986)) and Collins (1985).

laboratories will automatically produce new scientific knowledge.[24] RTD policies must take into account a broad variety of aspects of scientific research—funding, technical infrastructure, social institutions, training and teaching styles, publication possibilities, national culture, international scientific relations. Probably the most important result of this STS research is *the very possibility* of a policy dialogue on the contents of a RTD policy agenda: within the standard images of science and technology, there is no point in consulting anyone else than scientists and engineers about the RTD agenda.[25]

It is helpful to discuss STS work on *technological* development in some more detail. Sociological and historical studies have developed a constructivist analysis of technology in contrast to the standard image of technology that was largely 'technological determinist.' The resulting social shaping models stress that technology does not follow its own momentum or a rational goal-directed problem-solving path but that it is instead shaped by social factors. (See table 1 for a summary of standard and constructivist images of science and technology.)

Standard view of science and technology (and society)	**Constructivist view of science and technology (and society)**
Clear distinctions between the political and the scientific/technical domain	Both domains are intertwined; what is defined as a technical or as a political problem will depend on the particular context
Difference between 'real science' and 'trans-science'	All science is value-laden and may—again depending on the context—have implications for regulation and policy; thus there is no fundamental difference between 'real science' and 'trans-science', 'mandated science', or 'policy-relevant science'
Scientific knowledge is dis-covered by asking methodologically sound questions, which are answered unambiguously by Nature	The stabilisation of scientific knowledge is a social process
Societal issues can be reduced to the social responsibility of individual scientists and engineers	Development of science and technology is a social process rather than a chain of individual decisions; political and ethical issues related to science therefore cannot be reduced to the question of social responsibility of scientists and technologists
Technology develops linearly, e.g. conception –>decision–>operation	Technology development cannot be conceptualised as a process with separate stages, let alone a linear one

[24] Even in such esoteric fields as high energy physics, scientific knowledge has been shown to be influenced by the cultural, social and economic circumstances under which it is being produced (Traweek, 1988, 1992).

[25] This does not imply that a sociological study of science and technology is a panacea, and that philosophical, historical, economic, or policy oriented studies are not necessary as well. But our claim is indeed that it is a prerequisite for a policy dialogue on the very content of RTD.

Clear distinction between technology's development and its effects	The social construction of technology is a process that also continues into what is commonly called the 'diffusion stage'; the (social, economic, ecological, cultural, ...) effects of technology are thus part of the construction process and typically have direct *vice versa* implications for technology's shaping
Clear distinction between technology development and control	Technology does not have the context-independent status that is necessary to hope for a separation of its development and control; its social construction and the (political, democratic) control are part of the same process
Clear distinction between technology stimulation and regulation	Stimulation and regulation may be distinguishable goals, but need not necessarily be implemented separately
Technology determines society, not the other way around	Social shaping of technology and technical building of society are two sides of the same coin
Social needs as well as social and environmental costs can be established unambiguously	Needs and costs of various kinds are also socially constructed—depending on the context, they are different for different relevant social groups, varying with perspectives

Table 2 Standard and constructivist images of science and technology

In the Social Construction of Technology approach (SCOT)[26] 'relevant social groups' are the starting point. Technical artifacts are described through the eyes of the members of relevant social groups (including users/consumers). The interactions within and among relevant social groups can give different meanings to the same. Thus, for example, did Sipkes (1995) show how two research groups in a biotechnology laboratory developed two different pesticides; she traced these differences back to how different groups of farmers—respectively rich and poor—exerted influence on the pesticide research. As a result of the involvement of different groups, problems are defined differently and so are possible solutions, giving rise to different interpretations as to whether a problem has been solved or to the proper working of a technology. This interpretative flexibility demonstrates the necessity of a sociology of technology—it shows that neither an artefact's 'success' or 'failure', nor its technical 'working' or non-working,' are intrinsic properties of the artefact but subject to social variables. The lesson for this report is that technology is not merely constructed by engineers, but also by marketing departments, managers, anti-technology action groups, and consumers. Indeed, advocates of indigenous knowledge have argued that small farmers continuously experiment and often are more successful in improving agricultural techniques than the large agricultural research institutions. It is thus important to address issues in the wider cultural, political and economic milieu when formulating RTD policies. The paradigm shift that has occurred in the social studies of science and technology over the past twenty years, coincides with a very similar shift in thinking about development partnership. As Richard Carey, Deputy Minister for the

Comment: Ander voorbeeld

[26] See Bijker (1995) for a full account of this social construction of technology approach. For a summary, see Bijker (forthcoming in 2001).

Development Co-operation Directorate (DCD) at the OECD argued by quoting an OECD statement:

> 'Sustainable development (…) must be locally owned. The role of external partners is to help strengthen capacities in developing partner countries. To give substance to our belief in local ownership and partnership we must use channels and methods of co-operation that do not undermine those values. Acceptance of the partnership model (…) is one of the most positive changes we are proposing in the framework for development co-operation. In a partnership, development co-operation does not try to do things for developing countries and their people, but with them (…) Paternalistic approaches have no place in this framework. In a true partnership, local actors should progressively take the lead while external partners back their efforts to assume greater responsibility for their development.[27]

It is important to stress that the employment of this sociologically informed constructivist image of science and technology in society does not discredit other disciplines' work on RTD—such as that by economists, political scientists, or policy analysts. It only puts the latter in a broadened and shifted perspective that allows us to identify the strengths but also the limitations of these bodies of work and provide a better explanation of how they can be successful or unsuccessful in practice.

3.3 Science and technology in developing countries

Shrum and Shenhav give a comprehensive overview of science and technology in developing countries (Shrum & Shenhav, 1995). They discuss three theoretical perspectives that have been brought to bear upon the questions why and with what consequences developing countries do engage in scientific research and technological innovation.

The *modernisation* perspective believes that science is strongly linked to technology, and thus improves the ability of a country to promote growth through the more efficient use of its resources. In order to profit adequately, a country's economic infrastructure was considered to be crucial to absorb scientific research. Shrum and Shenhav cite various sources that question this direct relationship between scientific research, technological innovation and economic growth. Particularly important for this report's aim is to recognise that the modernisation perspective inadequately assumes a linear relationship between science and technology. These authors support the analysis of the previous section, by concluding that 'science penetrates the technological realm through a complex process consisting of several components but they do not occur in any determinate order. Often technological developments influence science' (Shrum & Shenhav, 1995: 630).

The *dependency* perspective stresses that scientific research is another mechanism of domination of the developing countries by the industrialised countries, 'not just by producing the technological means for the subjugation of the masses (in some accounts) but also as an ideological force and an inappropriate developmental model. The creation and maintenance of scientific institutions not only absorb personnel and capital but constitute an irrelevant ideological diversion for countries without the resources or the connections to pursue Western, specialty-oriented science' (Shrum & Shenhav, 1995:

[27] Report by OECD (1996:13), cited by Guehenno (1996: 4).

630). Researchers in developing countries are often linked to international scientific communities and the scientific core in industrialised countries, which often also set the research agenda. For this report, the issue of formulating a country's research agenda is crucial. A longitudinal study of 73 countries, in which a distinction was made between indigenous knowledge and scientific knowledge, has shown that for less developed countries there is no relationship between scientific knowledge and economic performance, and even a mildly negative correlation in the case of the poorest countries. Industrialised countries do show a positive correlation between economic performance and scientific knowledge (Shenhav & Kamens, 1991).

The perspective of *institutional* theory, which is complementary to the dependency perspective, highlights the isomorphism of scientific institutions in developing and industrialised countries. This isomorphism produces a shared orientation in values and organisational forms among scientific institutions in both kinds of countries. 'Through mimetic processes by which successful existing systems serve as models, scientific institutions and beliefs are prescribed and diffused as key elements of the modern world system' (Shrum & Shenhav, 1995: 631). This explains why all countries, albeit the questionable economic benefit discussed in the previous paragraph, are committed to promote (Western) science. For this report it is important to note the implied warning, that by adopting Westernised science and organisational forms, the comparability and compatibility of developing countries' research will be promoted, but solutions to local problems not necessarily so.[28]

While the previously discussed perspectives pertain to both science and technology, most of the studies on RTD in developing countries focus on technology more specifically. Technology has more direct relevance for dependency and development issues because it includes the development and improvement of industrial processes, transfer or invention of artifacts, establishment of information, communication and transportation infrastructures, improvement of crops and food production, and the shaping of social institutions. Here again the key theme is the presence or absence of ties within a country and between countries.

Relations between countries are almost always relations between organisations, either public or private. An important body of literature discusses the problems and advantages of 'technology transfer': the movement of artifacts and/or knowledge between countries. Much of technology transfer activities takes place within and via multinational companies. 'Received wisdom regarding the R&D activities of multinationals suggests a variety of negative effects, centring on the generation of dependence in recipients' (Shrum & Shenhav, 1995: 637). The focus of the project to which this report belongs is to enhance the RTD capacity within developing countries in a sustained and long-lasting way. The lesson is therefore that technology transfer is a less desirable method, because it may impair the development of domestic RTD capabilities that are appropriate to the country's stage and pace of socio-economic development.[29] State intervention and regulation are needed to support developing country's local firms in their relations with multinationals. This should be part of the country's science and technology policy.

[28] See Turnbull (1989) for a study of the complex agenda setting around malaria vaccine development in an Australian-Papua New Guinea collaboration.
[29] This is not to say that technology transfer can never play a positive role under specific circumstances. See Shrum (1995: 635-638, 641-643) for a review.

3.4 Science and technology policy

State action (including industrial, trade, and R&D policy) is deemed crucial to the promotion of science and technology for development. Science and technology policy in socialist countries has received much scholarly attention. India has been studied in detail because of its being relatively open and its having an active social scientific community. But studies of *how* science and technology policy is being made in developing countries are still rare.[30] As Shrum and Shenhav observe, 'Increasingly it is recognised that state organisations compete with other institutions in less developed countries and that (…) they are often too weak to implement unilateral change' (Shrum & Shenhav, 1995: 639). In the 1970's R&D policies stressed the institutionalisation of indigenous science and technology, while in the 1980's these 'self-reliant' policies were rethought and redefined.

Since the early 1980's, policy makers increasingly realised that it does not make sense to conceive of development policy as a series of isolated projects. Often the positive effects of projects were nullified by bad macroeconomic policies or mismanaged institutions at the micro level. Hence, Szirmai (1997:409) argues, since the early 1980's foreign aid is 'increasingly linked with a "policy dialogue" aimed at improvement of macroeconomic policy and institutional reform.' This was supported by a shift from project aid to programme aid. The dialogue element in the programme aid focuses, in this perspective, on establishing 'structural adjustment programmes aimed at macroeconomic stabilisation and deregulation of the economy' (Szirmai, 1997: 409). In this report we argue for a broader conception of 'policy dialogue', which is not restricted to this macroeconomic goal, but also addresses the problem of the increased tension between national and local development and the disruptive consequences that the linking up with the high speed environment of the global market may have.[31]

3.5 Policy dialogue

The concept of 'policy dialogue' was introduced to the development policy discourse in the context of 'conditionality': setting conditions to foreign aid. These conditions referred primarily, though not exclusively, to economic policy. The observation of human rights, for example, might also be a condition, although Western policy has been very erratic in this respect. For our purposes, it is more important to stress that also social policy and RTD policy can be part of the policy dialogue. The arguments for this can be found in the previous sections.

Apart from bringing non-economic aspects to the table of a policy dialogue, the STS perspective has more radical implications. These implications derive from the very different view of science and technology. The received view of policy dialogue builds on the necessary link between macroeconomic policy and development aid. We propose an extended conception of policy dialogue which, additionally, recognises the socially constructed character of science and technology and therefore stresses the need to encompass a variety of other aspects as part of a successful research and technology for development policy. A policy dialogue as basis for RTD policy should, for example, address the relations between 'Western' and indigenous knowledge; the conditions for an endogenous development and reform of the country's institutional RTD infrastructure (in contrast to mimicking the institutional patterns that developed in the

[30] See Shrum (1995) for literature references.

[31] With a focus on Asia, a similar argument is made by Pinkney (1993: 5-17).

advanced economies of industrialised countries); the conditions and formats for productive international co-operation via firms, universities, NGO's, and governmental organisations; the various implicit conceptions of 'development' and 'beneficiaries'; the mechanisms that affect the equal distribution of benefits; the consequences of linking up with the global market and the ability to solve pressing local problems; the country's educational and RTD capacities.

Finally we need a further extension of the 'policy dialogue' concept. We already argued the need to extend the subject matter to encompass a much wider variety of social, cultural, epistemological, and political aspects. The dialogue should also be extended to other levels: besides the dialogue on the level between the donor countries and the developing nations, it is also necessary to stimulate a policy dialogue on the level within the developing country and on the level among developing countries. This is, again, supported by the previous analysis of science and technology. Science and technology do not develop in isolation and hence a country's RTD policy needs to be fuelled by national discussions among stakeholders, policy makers, researchers, private companies, NGO's; as well as by inter-regional discussions among different developing countries.

4 Methodology for Diagnostic Studies of RTD Policies in ACP Countries

To administer an adequate therapy, one needs a good diagnosis. To formulate a RTD policy, one needs an adequate description and analysis of the research, technology and development situation in a country—a diagnostic study of RTD policy. This comprises a diagnostic description of the RTD *policies* as well as the RTD *landscape.* And when one wants to build a RTD policy *via a policy dialogue*, this sets specific criteria for such a diagnostic study. In this chapter we will formulate such criteria. Each small section is summarised in points for a checklist (cumulatively presented in appendix 1). These methodological criteria are proposed with two aims in mind: first, to help researchers design their own projects; and second, to help national governments and the EU Commission to evaluate RTD Diagnostic Studies.

The methodological sections all build on a broader vision of science, technology, society and development. The next and final chapter of this report reviews this broader background.

4.1 Conceptions of policy, and development

The argument for a RTD policy dialogue in this report is founded on recent rethinking of international aid and partnership. It does not make sense, we argue (see below, chapter 5), to conceive of development policy as a series of isolated projects; rather, it is necessary to link foreign aid with reform of macroeconomic policy and institutional infrastructure. The next step is to recognise that RTD policies need to address a wide set of issues: technology policy cannot do without an economic reform policy, science policy cannot do without educational capacity building, policies to reform the institutional infrastructure cannot do without international collaboration policy. These policies are destined to fail, or even to be damaging, when they do not properly fit with the socio-economic pre-conditions and cultural particularities of the country in order to meet the desired direction and manageable pace of development. Such a broad scope is based on the observation that there are no neutral facts or technologies—all knowledge and all technologies are infused with politics and thus value-laden. This also applies to the concept of 'development.' Proper goals for a nation's development cannot logically be derived from some *a priori* principles, but need to be established in and through a policy dialogue. Nor is the impact of research and technology on development a straightforward one: explicit discussion of the strategic effects of science and technology on development is necessary.

Checklist issues	
1	Is RTD policy linked to a wide set of issues? Such as for example: - research institutional infrastructure - research funding structure - foreign aid structure, private and governmental - intellectual property right and patent regulation - international research collaboration; both among universities and via NGO's, and multinational companies
2	Is it well recognised that all scientific knowledge and technological artefacts are value-laden? In other words: are concrete technical and scientific accomplishments not used in

	naively neutral and objectifying terms?
3	How is 'development' conceptualised?
4	How is the impact of science and technology on development viewed?

4.2 Conception of 'policy dialogue'

In the previous section we addressed the question how to conceptualise policy and development. For our present purposes we need to complement this with the specific conception of *dialogue*. A conception of 'policy dialogue' has several elements.

First, we need to distinguish 'policy dialogue' on three levels:

1 intra-national (within the country and within the government, involving national level organisations but also local stakeholders)
2 inter-regional (among several developing countries in the region)
3 inter-national (with donor countries).

This has implications for the types of actors and institutions that are described.

Second, to pay due respect to the *dialogue* character of the policy dialogue, the policy dialogue must be interpreted as an on-going, open learning process. With this phrase we mean:

- *open*: the policy goals and priorities are not fixed at the outset, but are amenable to revision during the dialogue;
- *learning*: the policy dialogue has means to record and make widely available the arguments, decisions, results, successes and failures of the policy process;
- *process*: the focus is not as much on the products of the policy dialogue, as it is on the process of reaching decisions on RTD policy.

The policy dialogue must be implemented as an open learning process when it is really meant to strengthen the infrastructural base for RTD policies in developing countries, rather than merely 'selling' donor countries' ideas.

Mutual learning and the development of a shared understanding of problems and of trust among participants, achieved in and through the process, are also important results of the dialogue, in addition to products such as reports detailing the new policy. In this perspective experts or consultants are process facilitators rather than providers of content.

Qualitative indicators of the *open* character of the process are the variety of actors involved; the existence of procedures to guarantee outside influence; and the existence of procedures to take into account the views of end-users and of the private sector.

For adequate *learning*, qualitative indicators are the openness of accounting and reporting procedures and styles; the development of trust and mutual recognition and appreciation among participants of each other's specific competencies; the level of reflexivity (with regard to content), that is, the willingness among participants to discuss, recognise and (re)consider implicit assumptions and limitations in each position, argument or approach.

Qualitative indicators for the *process* character are: a tolerance for failures; regular evaluation of progress and adjustment of goals; flexibility of procedures; the level of reflexivity (with regard to process), that is, the willingness to discuss whether procedures in- or exclude relevant groups, favour or suppress specific positions or arguments; a general transparency of the policy dialogue process.

Third, a policy dialogue on RTD should at least address the following principal issues:

- ? the enormous task of *developing new national RTD policies* in ACP countries
- ? the formulation of *strategies for supporting institutional reforms of RTD infrastructures* and for *strengthening national RTD capacities* in ACP countries
- ? the *intensification of scientific co-operation* at national, regional and international levels;
- ? the identification of *innovative funding mechanisms* to develop and sustain appropriate RTD infrastructures

Additionally, the RTD policy dialogue should also address the following issues:

- ? the production of a proper fit between RTD-policies and the country's socio-economic conditions and cultural context
- ? the conditions and formats of collaboration that help to meet national and local development needs, and stimulate long-term domestic RTD-capabilities
- ? strategies to address the consequences of the country's linking up with the global market,
- ? strategies to balance the fast pace of change (fuelled by the advanced economies of industrialised countries) in the global market with the pace of change that local and rural communities can tolerate without being disrupted.

Fourth, the conception of RTD policy dialogue should allow for the participation of a variety of relevant actors and groups, such as for example:

- ? the (intended) end-users of technologies, who should be involved in the earliest possible stage in formulating the research and innovation goals, so as to promote the best possible fit between innovation and implementation.
- ? the public authorities in ACP countries, who are in charge of
- ? -formulating and implementing national (and regional) RTD policies (including regulations of intellectual property rights, of (tele)communications, imports/exports of goods and services, etc.), and
- ? -reforming and strengthening their national RTD infrastructures and capabilities, in both the public domain and the private sector.
- ? the EC and the donor agencies of the EU Member States, Norway and Switzerland who may wish to adjust their own positions on new ACP policies relating to RTD reform.
- ? the RTD communities (universities, research institutes and networks) in ACP countries, who should play an active role in
- ? -establishing priorities in RTD policies,
- ? -developing sustainable sources of funding for their implementation, and
- ? -promoting (innovative) forms of collaboration with universities, research institutes and private sector organisations within both their region and the EU Member States, Norway and Switzerland.
- ? the NGO's and (multinational) private sector organisations.

? local level stakeholders (which are not necessarily organised or represented at the national level).

Checklist issues	
5	Are three levels of policy dialogue distinguished? - intra-national - inter-regional - inter-national
6	Is the policy dialogue operationalised as an *open* process? By identifying (if existing): - a wide variety of actors and institutions involved (see also the separate criterion 9 below) - the procedures giving 'outsiders' access to the policy dialogue - the influence of end-users - the influence of the private sector
7	Is the policy dialogue operationalised as a *learning process*? By identifying (if existing): - procedures for accounting and checking the dialogue - procedures for reporting the results of the policy dialogue - positive strategic reactions to failures - flexibility in maintaining procedures and devising new ones - a reflexive attitude with regard to both content and process of the policy dialogue - transparency of the policy dialogue process
8	Is the policy dialogue addressing the necessary issues? These should include at least: - the development of new RTD policies - reform of RTD institutions - strengthening of national RTD capacities - intensifying international RTD collaboration - innovation of the funding structures - conditions for productive collaboration - fit with socio-economic and cultural context - the difference in pace of change in the global market and the pace of change that local communities can tolerate without serious disruption
9	Are all relevant social groups, institutions and actors involved in the policy dialogue? These should include at least: - user groups, potential users, local and national stakeholders - public authorities in ACP countries - donor agencies of EC, EU member states, Norway, and Switzerland - RTD communities and institutions - NGO's - multinational companies

4.3 Description of the RTD Landscape

The policy dialogue is geared towards developing a RTD policy. That requires an adequate description and assessment of the RTD landscape—the universities, private and public research institutions, funding agencies, NGO's, and relevant regulatory agencies and other governmental offices.

Checklist issues	
10	Is the RTD landscape described? In terms of institutions: - the universities - private and public research institutions - funding agencies - NGO's - relevant regulatory agencies and other governmental offices And in terms of relevant indicators:

- scientific and technological workforce
- financial budgets
- scientific and innovative production

4.4 Analysis of power relations

The parties involved in a policy dialogue are not neutrally acting without any interests or agenda's of their own. To understand the dynamics of the policy dialogue and of science and technology development in a country, an adequate description is needed of the power relations between the various institutions. Several aspects are relevant. Besides the economic, ethnic and political hierarchies, also the policy with respect to (intellectual) property rights and the patenting situation are important.

Checklist issues	
11	Have the hierarchical relations between the various research institutions, funding agencies, ministries, NGO's and multinational companies been mapped adequately?
12	Has the state regulation been described which sets conditions to research and development within multinational firms and within national private business?
13	Have the national and international regulations been described which pertain to (intellectual) property rights and patenting?

4.5 Conception of science and technology

After setting the general stage of policymaking and policy dialogue, we now turn to the specific subject matter of science and technology. We argue in this report that it is important to avoid too naïve an image of science and technology. These standard images tend to deny the social, cultural, political, and historical dimensions of science and technology, and thus basically deny the very possibility of a RTD policy that also aims at influencing the research and innovation agenda substantially. To avoid these inadequate and ineffective images of science and technology, it is necessary to take into account the results of the past two decades of STS research (see chapter 5, below). Concretely, this implies the need to map all relevant social groups, instead of only engineers and scientists. In doing so, special attention should be paid to the variety of cultural, regional, and national sources of knowledge and technology (e.g. indigenous knowledge and traditional techniques).

Checklist issues	
14	Have all the relevant social groups, involved in a specific scientific or technological development, been described?
15	Have all relevant forms of indigenous knowledge, craft knowledge, and local expertise been described?

4.6 Fields of science and technology

To exploit the potential of a country's scientific and technological capacity, a broad view of what constitutes new developments in science and technology is crucial: areas such as biotechnology, ICT, agricultural technologies, marine technologies all need to be covered. Do not only cover those fields most likely to contribute to the country's ability to link up with the global marked. Describe also fields more likely to address

local level development needs. Avoid the trap of equating technological progress too easily with information and communication technologies. To give historical perspective to the science policy dynamics of a country, recent shifts of focus between fields of research and technology need to be indicated. If a country has an explicit research and technology for development policy, it should be fully described.

Checklist issues	
16	Were all relevant fields of science and technology covered—those enhancing the country's ability to link up with the global market, as well as those aiming at resolving local level needs? Has, for example, the trap been avoided of identifying technological progress with computers only?
17	Have changes in focus between fields of science and technology during the past decade been documented?
18	Have the country's RTD policy plans been described?

4.7 Implementation of science and technology policies

An often made mistake, in the public domain as well as in private business, is to assume that once a new scientific finding is communicated or a new technical innovation is demonstrated, all the rest will follow automatically. Nothing is less true. Research findings and technological innovations need to be marketed and implemented. This marketing, moreover, is not a straightforward process of kicking the new fact or artefact into the wider world: it needs continuous management, translation and coaching. Hence, a RTD diagnostic study needs to pay explicit attention to such issues as demonstration, adoption-adaptation, implementation, and diffusion. Here again, it is important not to deny the existence of failures, since failures may teach more interesting lessons than successes.

Checklist issues	
19	Is the implementation phase of scientific findings and technological innovations treated with enough attention? This may, for example, involve separate funding or management structures.

5 Toolbox for generating diagnostic studies

The various elements that are presented in this report add up to a toolbox that can be used for generating RTD diagnostic studies. Tools in a toolbox, however, can never stand alone. Even the best tools do not guarantee good work. Tools will only work when used by skilled people—tools need to go with written manuals and need to be handled with unwritten tacit knowledge. This chapter should be read with these limitations in mind: it offers tools, but can only be handled in connection with the rest of this report used as a kind of manual. Also, the tools should be used by people with the relevant knowledge and skills for doing social studies of science and technology in developing countries. This toolbox does not provide those basic knowledge and skills, although it does provide some means for acquiring and training them.

5.1 Ingredients of the toolbox

The toolbox' contents can be best described by following the process of stimulating and implementing research and technology for development. The first step in that process is to define the problem in the right terms, and to make the relevant politicians and policy makers see an adequate problem definition (section 5.2). Once that general insight is gained, concrete steps need to be taken within the context of the EU-ACP agreement. That means the translation of the general political vision into a concrete bureaucratic strategy. Without framing the general issue in the right technocratic and bureaucratic terms, it will not survive (section 5.3). Once the concrete political and bureaucratic conditions are set, diagnostic studies need to be carried out. But to do that, researchers have to be trained to use the methodology. This can best be done in small, intensive workshops (section 5.4).

This toolbox should be viewed as a dynamic, continuously updated knowledge and skills base. All tools in this box will develop and improve over time, when more people use them in various contexts and circumstances and feedback their experiences.

5.2 Defining the issue of RTD

Key elements in the problem definition as argued in this report are (1) the central role of science and technology for developing countries, (2) the need to formulate policies on the basis of a proper insight in the specific situation in a country, (3) the proposition that such policy formulation should be done on the basis of a policy dialogue, and (4) the employment of a constructivist perspective on science and technology to have an effective handle on shaping the influence of science and technology.

In summary, the core argument for RTD as proposed in this report is thus the following:

- Science and technology are crucial for a long-term and stable development of a country
- Precise aims for scientific and technological development should be specifically formulated for each country
- The formulation of these specific aims should be based on a proper insight in the present situation of the country and its planned future development: this insight is offered by a RTD Diagnostic Study
- Carrying out a RTD Diagnostic Study means to engage into a process of policy dialogue in which the developing country (and its many internal parties) and donor countries jointly formulate objectives, strategies, and means to support the development of that country

- A constructivist perspective on the role of science and technology in society is most adequate to guide this policy dialogue and carry out these diagnostic studies.

5.3 Framing the issue in the context of the Cotonou Agreement

For RTD projects in which the European Union is involved, the Cotonou Agreement is the central framework.[32] The Cotonou Agreement supports the approach presented in this report. The agreement, for example, explicitly asks for participation of a variety of actors with the countries, using the concepts of "civil society" and "political dialogue." Also, the Cotonou Agreement mentions at various instances the role of research and technology, for example in articles 21 (on investment and private sector development), 30 (on regional cooperation), and 32 (on environment and natural resources).

Concretely, the first step in framing the strategy for RTD within the Cotonou Agreement is to include it in the national and regional indicative plans (NIP's and RIP's). It seems advisable to include the RTD Diagnostic Studies as separate strategic element, together with a variety of plans for institutional capacity building and research investments. It is also effective to work along two parallel lines: national and regional collaboration with the EU.

For collaboration between ACP countries and individual EU-member states, the Cotonou Agreement is less important as a restrictive framework, and the strategy of carrying out a RTD Diagnostic Studies could be discussed directly.

5.4 Organising a workshop to train researchers and policy makers

RTD diagnostic studies are the key element in the strategy developed in this report, to shape and stimulate research and technology for development. Such diagnostic studies must be carried out by experienced and well-prepared senior researchers. These researchers preferably have some experience in studying science and technology in society; they may be of varied disciplinary background; for example from the social sciences with some affinity to natural sciences and technology, or *vice versa*.

It is not enough, however, to have these senior researchers and hand them the methodology. No methodology can be read as a cookbook recipe, but should be mastered in practice—learned "on the job." To save precious time, this learning can most effectively be done in a workshop where researchers who already carried out diagnostic studies previously, share their experience with new researchers.

Although the primary focus in these workshops should be on the training of researchers who are to carry out the RTD diagnostic studies, it is attractive—and indeed highly effective—to use them for an additional goal as well. One of the recurrent themes in this report has been that research and technology should not be viewed as isolated activities in society. RTD should instead be viewed as part of the complex network that constitutes civil society: end users, funding bodies, small local companies, multinational corporations, policy makers, etc. Including some of these people in the workshop would act as a two-edged sword. First, these policy makers and private business people will get to understand some of the basic concepts underlying the new strategy of stimulating

[32] For a good introduction into the Cotonou Agreement and its practical implications, see the ECDPM Infokit (ECDPM, 2001). The agreement itself has been published in *The ACP-EU Courier, special issue on Cotonou Agreement"* of September 2000.

RTD and thus be more positively prepared for what in next steps will be asked of them. And second, the researchers are confronted with some of the standard problems and objections they will encounter when talking to these various groups in society. Thus the workshop becomes a kind of "learning laboratory" in which the researchers are trained almost as if really "on the job", but quite efficiently condensed in time and space.

Below follow elements for organising such a workshop. This should, of course, be adapted to local circumstances and specific needs when used as model for a real workshop. I apologise for the triviality of some of the items, but a good toolbox also contains simple nails…

5.4.1 Organisational infrastructure

The space requirements are:

- One room allowing all participants to sit at one *carré* of tables
- Separate small rooms (or corners in larger rooms) for four small groups to work simultaneously
- Opportunity to have lunch and dinner together

Standard equipment such as white or black board, paper sheet stand, overhead projector, computer beamer, and a photocopy machine should be available, continuously and on the spot. The walls of the plenary room should allow the mounting of large sheets of paper with group work results.

It is crucial that all participants stay in the same hotel and that there is ample opportunity of unstructured and informal interaction.

The substantive process of interaction and learning should be supervise by two highly qualified senior scientists with recognised relevant expertise on the issues. They act as a team, alternatingly chairing the sessions and kicking up the discussions. One administrative assistant is important as "organisational fire brigade."

5.4.2 Participants

A maximum of 20-25 participants is important to guarantee enough interaction. A possible distributions would be:
10 researchers to be trained
5 experiences researchers as resource persons
5 policy makers / industrialists / etc.
2 senior scientists to chair the workshop and guide the learning process

A balanced mix of gender, race, scientific discipline and nationality is beneficial for a productive interaction.

The idea is to have a *workshop*, not a conference. Hence, all participants should be able to be present during the full three day period, including all formal and informal occasions; and no "zapping in and out" by outsiders should be allowed. A meeting place "in the middle of nowhere" would therefore be ideal. An occasional lecture can be given by an outside resource person.

5.4.3 Programme

However adapted, it is important that the programme of the workshop maintains a deliberate balance: between plenary and group work, between listening and active participation, between abstract and concrete, between scientific and political. A possible programme is attached to this report as appendix 7.

5.5 Carrying out RTD Diagnostic Studies

The final step then, is to carry out the diagnostic study. The researchers contracted to do this have been trained in the workshop, discussed in the previous sections. To guarantee the process character of the diagnostic study, it is important to have an infrastructure in place to support the researchers. This infrastructure will encompass national and international contacts.

Nationally, it seems wise to have a kind of advisory committee in place. This committee can help the researchers to reflect critically upon their findings. Such a committee can also be used to create—in an early stage—a supportive basis among politicians and governmental administrations, the research community, and civil society.

Internationally, a network will be built of researchers who are involved in similar projects. The ThinkTank that presently supports this project is a model for the facilitation of such a group of researchers.[33] The on-going modification and improvement of the methodology for carrying out RTD diagnostic studies can thus be shared by all researchers.

[33] http://www.oneworld.net/thinktank/rtd/index.html

6 Appendix: Checklist for making a RTD Diagnostic Study

1	Is RTD policy linked to a wide set of issues, such as for example: - research institutional infrastructure - research funding structure - foreign aid structure, private and governmental - intellectual property right and patent regulation - international research collaboration; both among universities and via NGO's, and multinational companies
2	Is it well recognised that all scientific knowledge and technological artefacts are value-laden? In other words: are concrete technical and scientific accomplishments not used in naively neutral and objectifying terms?
3	How is 'development' conceptualised?
4	How is the impact of science and technology on development viewed?
5	Are three levels of policy dialogue distinguished? - intra-national - inter-regional - inter-national
6	Is the policy dialogue operationalised as an *open* process? By identifying (if existing): - a wide variety of actors and institutions involved (see also the separate criterion 9 below) - the procedures giving 'outsiders' access to the policy dialogue - the influence of end-users - the influence of the private sector
7	Is the policy dialogue operationalised as a *learning process*? By identifying (if existing): - procedures for accounting and checking the dialogue - procedures for reporting the results of the policy dialogue - positive strategic reactions to failures - flexibility in maintaining procedures and devising new ones - a reflexive attitude with regard to both content and process of the policy dialogue - transparency of the policy dialogue process
8	Is the policy dialogue addressing the necessary issues? These should include at least: - the development of new RTD policies - reform of RTD institutions - strengthening of national RTD capacities - intensifying international RTD collaboration - innovation of the funding structures - conditions for productive collaboration - fit with socio-economic and cultural context - the difference in pace of change in the global market and the pace of change that local communities can tolerate without serious

	disruption
9	Are all relevant social groups, institutions and actors involved in the policy dialogue? These should include at least: - user groups, potential users, local and national stakeholders - public authorities in ACP countries - donor agencies of EC, EU member states, Norway, and Switzerland - RTD communities and institutions - NGO's - multinational companies
10	Is the RTD landscape described? in terms of institutions: - the universities - private and public research institutions - funding agencies - NGO's - relevant regulatory agencies and other governmental offices and in terms of relevant indicators: - scientific and technological workforce - financial budgets - scientific and innovative production
11	Have the hierarchical relations between the various research institutions, funding agencies, ministries, NGO's and multinational companies been mapped adequately?
12	Has the state regulation been described which sets conditions to research and development within multinational firms and within national private business?
13	Have the national and international regulations been described which pertain to (intellectual) property rights and patenting?
14	Have all the relevant social groups, involved in a specific scientific or technological development, been described?
15	Have all relevant forms of indigenous knowledge, craft knowledge, and local expertise been described?
16	Were all relevant fields of science and technology covered—those enhancing the country's ability to link up with the global market, as well as those aiming at resolving local level needs? Has, for example, the trap been avoided of identifying technological progress with computers only?
17	Have changes in focus between fields of science and technology during the past decade been documented?
18	Have the country's RTD policy plans been described?
19	Is the implementation phase of scientific findings and technological innovations treated with enough attention? This may, for example, involve separate funding or management structures.

7 Appendix: Model Workshop Programme

The following schedule offers a model for a workshop to train the methodology proposed in this report.

Timing	Activity	Format
Day 1		
9:30	Coffee	
10:00	Welcome and explanation of goals and programme	Plenary presentation
10:30	Introduction of all participants	Round table
11:00	Introductory lecture "Why RTD Diagnostic studies?"	Plenary presentation
12:00	Discussion on the lecture, resulting in list of questions to be addressed in the remainder of the workshop	Round table
13:00	Lunch	
15:00	Case-study: "The RTD Diagnostic Study of country X"	Plenary presentation
16:30	Tea	
17:00	Identification of key problems and possible solution strategies	Group work
18:30	Closing	
Day 2		
9:00	Reporting the results of yesterday's group work	Round table
10:30	Coffee	
11:00	Discussion of the methodology and checklist, in confrontation with groups' inventories of problems	Round table
13:00	Lunch	
15:00	Elaboration of different sections of the methodology and checklist	Group work
16:30	Tea	
17:00	Presentation of group work	Round table
17:30	Lecture: "RTD and the Cotonou agreement"	Plenary presentation
19:00	Closing	
Day 3		
9:00	Case-study: "Practical problems while carrying out the RTD diagnostic study of country Y"	Plenary presentation
10:30	Coffee	
11:00	Designing the work plan for the RTD diagnostic studies in one's	Group work

	own country	
13:00	Lunch	
15:00	Presentation of group work, checking against the checklist	Round table
16:30	Tea	
17:00	Closing session: checking the list of questions made at the first morning	Plenary presentation and Round table
18:30	Closing	

8 Appendix: Set of initial diagnostic studies

The RTD diagnostic studies listed below were examined as examples of 'current practice' with regard to diagnostic RTD studies. These studies were carried out in 1996-1998, and published recently. They served as a backdrop for this report. Here we limit ourselves to some general remarks.

The process that produced these reports was different in each case, as was the extent to which methodological aspects were accounted for in each report. Only the study of the Dominican Republic was set up with this project in mind. The Vietnam report was commissioned by the Vietnamese government as an expert input into the preparation of a long-term development plan for the country. In this sense this report differs from the cases of Uganda and Ghana where long term development objectives were already in place, attributing an important role to the development of a domestic science and technology capacity, from which the objectives of a S&T policy could be derived.

Some version of a *national systems of innovation* approach is present in all five country reports we have examined—either explicitly or implicitly; in a rudimentary form roughly compatible with a national systems of innovation approach, or in a theoretically elaborate and sophisticated form. The notion of 'national systems of innovation' is well developed in the economics of innovation literature and adopted by the OECD. This notion focuses on the development, harmonisation and management of *institutional networks*. The performance of these institutional networks is measured by quantitative methods: collecting and processing data on S&T indicators. This approach puts formal relationships between organisations into focus, as well as formally defined goals and operating procedures.

As a result of the national systems of innovation approach, all reports focus on a national or regional (in the case of Uganda) level and focus on institutional networks, legislation, funding, human resources, education and training, inter-sectoral and international collaboration, etc. Although the coherence induced by the notion of national systems of innovation is a strong point of this approach, there are weaknesses too. The approach is incapable of grasping informal, micro-level processes that may be important in making collaboration work. It is not able to address issues of scientific and technological content, or of the cultural base of knowledge. There is no or little sensitivity to cultural issues, cultural differences, other than as constraints or threats to the full integration of the S&T institutional network in the general policy network, or as irrational historical vestiges of past frictions that have to be overcome.

In all reports the globalisation perspective takes prominence as a central objective of S&T policy overtargeting S&T towards improving the living conditions of the poor. The Vietnam report explicitly addresses the disruptive consequences of linking up with the high velocity environment of the global market. However, it accepts these consequences as inevitable, and concludes that social safety nets should be provided.

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9 Appendix: Set of critical assessment studies

The following studies have been carried out on the basis of a prototypical methodology, developed in the first stage of this research project. They were not intended as full RTD Diagnostic Studies, but rather as critical assessments of what has been accomplished in terms of a policy dialogue since the first set of studies (see appendix 8) was carried out.

The results of these studies, and the experiences of their researchers with the prototypical methodology, need to be studied carefully in order to further improve the methodology proposed in this project. Our present report does not do that, because it was already completed when these critical assessment studies were delivered.[34]

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Tindimubona, A.R. (2000) *The National Policy Dialogue on Research and Technology for Development in Uganda,* ASTEX, Kampala..

[34] A summary and analysis is offered by Engelhard (2000).

10 Relevant literature

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