TECHNOLOGICAL RESPONSIBILITY
Guidelines for a shared governance of the processes of socialisation of scientific research and innovation, within an interconnected world

Edited by Daniele Mezzana

Editorial board
Alfonso Alfonsi, Wiebe Bijker, Haribabu Ejnavarzala, Kevin Urama, Wendy Taylor, Shambu Prasad

Science, Ethics and Technological Responsibility in Developing and Emerging Countries

Project Coordinator
Dr. Massimo Cannatà
The project leading to these results has received funding from the European Community’s Seventh Framework Programme FP7 / 2007 - 2013 under the grant agreement n° 217811.

SET-DEV Project is coordinated by Dr. Massimo Cannatà – CNR.

Work Package 10 is coordinated by Laboratory of Citizenship Sciences.

**Legal notice**

The views expressed in this publication are the sole responsibility of the author and do not necessarily reflect the views of the European Community. The Community is not liable for any use that may be made of the information contained therein.

Design and layout by Simona Morante and Fernando Polidoro.

May 2011
# Table of Contents

ABOUT SET-DEV PROJECT ........................................................................................................... 1

ACKNOWLEDGEMENTS .............................................................................................................. 3

INTRODUCTION ............................................................................................................................ 5

  OBJECTIVES AND TARGET ................................................................................................. 6
  STRUCTURE OF THE GUIDELINES ..................................................................................... 7
  THEORETICAL AND METHODOLOGICAL FRAMEWORK .................................................. 8
  THE SOURCES OF THE GUIDELINES ................................................................................. 18

GENERAL SUMMARY .................................................................................................................. 21

CHAPTER ONE - AREA 1 SCIENTIFIC PRACTICE ..................................................................... 37

  FRAME OF RESPONSIBILITY 1 CONTEXTUALISATION OF RESEARCH ................................. 39
  FRAME OF RESPONSIBILITY 2 QUALITY OF RESEARCH .................................................. 44
  FRAME OF RESPONSIBILITY 3 RESEARCHER’S IDENTITY ................................................ 48
  FRAME OF RESPONSIBILITY 4 GENERATIONAL CHANGE .................................................. 51

LESSONS LEARNT ON SCIENTIFIC PRACTICE .................................................................... 53

  SUMMARY ............................................................................................................................... 55

CHAPTER TWO - AREA 2 SCIENTIFIC MEDIATION .................................................................. 57

  FRAME OF RESPONSIBILITY 5 GENERAL MANAGEMENT AND ADMINISTRATION OF RESEARCH .......................................................... 58
  FRAME OF RESPONSIBILITY 6 KNOWLEDGE MANAGEMENT AND CIRCULATION ........ 62
  FRAME OF RESPONSIBILITY 7 NEW TEACHING FUNCTIONS .......................................... 65
  FRAME OF RESPONSIBILITY 8 TERRITORIAL AND INTERNATIONAL RELATIONS ........ 67
  FRAME OF RESPONSIBILITY 9 RESEARCH DESIGN FOR FUNDING ................................. 70

LESSONS LEARNT ON SCIENTIFIC MEDIATION .................................................................... 74

  SUMMARY ............................................................................................................................... 75

CHAPTER THREE - AREA 3 SCIENTIFIC COMMUNICATION ..................................................... 77

  FRAME OF RESPONSIBILITY 10 INTRA-EPISTEMIC COMMUNICATION .............................. 79
  FRAME OF RESPONSIBILITY 11 TRANS-EPISTEMIC COMMUNICATION ............................ 81
  FRAME OF RESPONSIBILITY 12 NETWORK COMMUNICATION ........................................ 83
  FRAME OF RESPONSIBILITY 13 SOCIAL COMMUNICATION ............................................ 85
  FRAME OF RESPONSIBILITY 14 DIALOGUE AMONG DECISION MAKERS AND RESEARCHERS .......................................................... 90
  FRAME OF RESPONSIBILITY 15 GENERAL COMMUNICATION .......................................... 93
  FRAME OF RESPONSIBILITY 16 RESEARCHERS’ ATTITUDE TO SCIENTIFIC COMMUNICATION .......................................................... 97
  FRAME OF RESPONSIBILITY 17 RELEVANCE AND ACCESSIBILITY OF SCIENTIFIC COMMUNICATION ........................................ 100
LESSONS LEARNT ON SCIENTIFIC COMMUNICATION

SUMMARY

CHAPTER FOUR - AREA 4 EVALUATION

FRAME OF RESPONSIBILITY 18 DISSEMINATION OF EVALUATION PRACTICE

FRAME OF RESPONSIBILITY 19 QUALITY OF EVALUATION

FRAME OF RESPONSIBILITY 20 ADAPTATION OF EVALUATION

FRAME OF RESPONSIBILITY 21 TRANSPARENCY OF EVALUATION

FRAME OF RESPONSIBILITY 22 QUALITY OF EVALUATORS

LESSONS LEARNT ON EVALUATION

SUMMARY

CHAPTER FIVE - AREA 5 INNOVATION

FRAME OF RESPONSIBILITY 23 TECHNOLOGY AND KNOWLEDGE BROKERING

FRAME OF RESPONSIBILITY 24 COPING WITH TECHNOLOGICAL PLURALITY

FRAME OF RESPONSIBILITY 25 ATTITUDE OF RESEARCH INSTITUTES TO INNOVATION

FRAME OF RESPONSIBILITY 26 ATTITUDE OF ENTERPRISES TO INNOVATION

FRAME OF RESPONSIBILITY 27 PROMOTING A RESEARCH-BASED ENVIRONMENT FOR INNOVATION

FRAME OF RESPONSIBILITY 28 JURIDICALLY AND FINANCIALLY ENVIRONMENT FOR INNOVATION

FRAME OF RESPONSIBILITY 29 INNOVATIVE SPIRIT IN THE POPULATION

LESSONS LEARNT ON INNOVATION

SUMMARY

CHAPTER SIX - AREA 6 GOVERNANCE

FRAME OF RESPONSIBILITY 30 QUALITY OF POLICY SETTING

FRAME OF RESPONSIBILITY 31 DIALOGUE AND PARTICIPATION IN POLICY MAKING

FRAME OF RESPONSIBILITY 32 POLICY IMPLEMENTATION

FRAME OF RESPONSIBILITY 33 PARTICIPATIVE STRUCTURES FOR STAKEHOLDERS AT LOCAL LEVEL

FRAME OF RESPONSIBILITY 34 FINANCIAL RESOURCES AND INFRASTRUCTURE FOR RESEARCH

LESSONS LEARNT ON GOVERNANCE

SUMMARY

CHAPTER SEVEN - AREA 7 GENDER

FRAME OF RESPONSIBILITY 35 EQUAL OPPORTUNITY AND TRANSPARENCY

FRAME OF RESPONSIBILITY 36 RECONCILIATION AND SUPPORT

FRAME OF RESPONSIBILITY 37 RAISING AWARENESS ABOUT GENDER ISSUES IN STR

FRAME OF RESPONSIBILITY 38 PRODUCTION OF KNOWLEDGE ON GENDER ISSUES IN STR

FRAME OF RESPONSIBILITY 39 MOVEMENT ON GENDER ISSUES IN SCIENCE AND TECHNOLOGY

LESSONS LEARNT ON GENDER
SUMMARY

CHAPTER EIGHT - AREA 8 SUBSTANTIVE APPROACHES

FRAME OF RESPONSIBILITY 40 TACKLING THE PLURALITY OF KNOWLEDGE SYSTEMS

FRAME OF RESPONSIBILITY 41 CONVERGENCE OF TRADITION AND MODERNITY

FRAME OF RESPONSIBILITY 42 SELF-RELIANCE

FRAME OF RESPONSIBILITY 43 REGULATIONS ON INDIGENOUS KNOWLEDGE

LESSONS LEARNT ON SUBSTANTIVE APPROACHES

SUMMARY

APPENDIX LESSONS LEARNT: EUROPE

BIBLIOGRAPHY
Figures and Tables

SET-DEV: The 8 areas of STR socialisation ................................................................. 14
Structure of the guidelines ....................................................................................... 17
Contextualisation of research: excerpts from the Indian and African Manifestos .......... 38
Meetings between researchers and stakeholders in India and Africa: SET-DEV capacity building workshops and focus groups ............................................................................. 40
The research community opening up to stakeholders: the experience of science shops ... 40
Meetings between researchers and civil society organisations at local level ................ 41
Scientists and civil society organisations in India ..................................................... 41
Egerton University (Kenya): dialogue with stakeholders and relevance of the research .. 41
Participatory methods in science and technology ..................................................... 42
Sanitation: pro-poor technologies in Kenya .............................................................. 42
Research quality and ethics in India ......................................................................... 45
Aspects of scientific misconduct ............................................................................. 46
Open Source Drug Discovery ................................................................................... 50
African Youth Forum on Science and Technology (AYFST) ........................................ 52
Lessons Learnt on Scientific Practice: Kenya .......................................................... 53
Lessons Learnt on Scientific Practice: India ............................................................ 54
The EDULINK Project in Africa .............................................................................. 59
NAARM (India): Training programme for technical and administrative staff .............. 60
A conducive work environment: experiences in Kenya ............................................. 61
Information services: some Kenyan experiences ..................................................... 63
Kenya Resource Database ...................................................................................... 64
Relations with private actors: Jawaharlal Nehru Technological University in Hyderabad 68
Matching experiences in Kenya .............................................................................. 69
Fundraising at the Institute of Life Sciences in Hyderabad ........................................ 71
Scientific mediation in India: the role of research councils and other public bodies .... 72
Lessons Learnt on Scientific Mediation: Kenya ....................................................... 74
Lessons Learnt on Scientific Mediation: India ......................................................... 74
Communication and participation as integral part of the research: elements from the "Manifestos" 78
The Kenya Agricultural Information Network ....................................................... 80
Trans-epistemic communication in an agricultural project in Kenya ......................... 82
Development of "metaperspectives" ....................................................................... 82
Communication with donor agencies ..................................................................... 84
Creating a common ground for dialogue: a resource centre on water ....................... 86
An experiment in scientific communication at the mass level: Bharat Jan Vigyan Jatha
Hysterectomy in India: a case study
KICS: a discussion forum on science and democracy
Civil society organisations in knowledge production
Talking soil science with farmers
Capacity building for African legislators
The policy brief
The "Public Understanding of Research" (PUR)
The "Public Understanding of Current Research" (PUCR)
The Calcutta City of Science
Children's Science Congress
ATPS: strengthening STR reporting
Joint seminars for journalists and researchers in India
African Science Café
The use of media “culturally” closer to the people
Kenya: communication and technology in cosmopolitan cities
Science and local languages
Some aspects of scientific communication in India
Lessons Learnt on Scientific Communication: Kenya
Lessons Learnt on Scientific Communication: India
The evaluation: excerpts from the Indian and African Manifestos
National scientific evaluation bodies in India: some examples
National scientific evaluation bodies in Kenya: some examples
Some approaches to STR evaluation
Accreditation of higher education institutions in India
Post-accreditation quality support in universities - India
National benchmarking of good practices as an instrument for the assessment of universities - India
Participatory approaches in evaluation - Kenya
Policy evaluation in the field of horticulture in Kenya
Ethical review procedures
Role of the “experts” and the need for transparency
Lessons Learnt on Evaluation: Kenya
Lessons Learnt on Evaluation: India
The two "Manifestos: for a contextualised innovation
India: Expanding science and technology parks and technology incubators
eSagu-An IT-based personalised agro-advisory system
Mapping local technological options: examples from Kenya and India ........................................... 138
Technological pluralism in post-disaster reconstruction: a case study in India .................................. 138
NGOs and the spread of solar energy in India ..................................................................................... 139
Learning alliances in India ................................................................................................................... 140
Technology-driven regulation in emerging economies: the respect for local cultures .................. 140
Kenya Management Assistance Programme: at the service of small and medium enterprises ...... 145
Up-scaling of Non-Pesticidal Methods of Pest Management (NPM) in Andhra Pradesh ............ 146
Indian inclusive innovation: scaling up pro-poor initiatives ............................................................... 147
India: the Technology Bureau for Small Enterprises ....................................................................... 148
Responsible partnering ....................................................................................................................... 149
Public-private partnership to fund biotechnological research in India .............................................. 151
Kenya: Looking into Tea Leaves ......................................................................................................... 151
India: Credit-Linked Capital Subsidy Scheme for technology upgrading ........................................ 152
ACTS: research in Africa on Intellectual Property Rights (IPR) ...................................................... 153
Gujarat (India): New approaches to post-disaster reconstruction ..................................................... 155
Kenya: trust and involvement of stakeholders for a “Cultural grounded technology” .................. 155
Some aspects of innovation in India: academic research and local expertise ............................... 156
Lessons Learnt on Innovation: Kenya ............................................................................................... 157
Lessons Learnt on Innovation: India ................................................................................................. 157
For an African Agenda on Research and Innovation ....................................................................... 164
New institutional frameworks to make science and technology relevant to India ............................ 165
“Kenya Vision 2030” .......................................................................................................................... 167
STR governance in EPW articles ......................................................................................................... 167
WASSAN: from research to policies .................................................................................................... 168
The European Commission and the Precautionary Principle: Guidelines .................................... 169
The African Ministerial Council on Science and Technology (AMCOST) and the Africa’s Science and Technology Consolidated Plan of Action (CPA) ......................................................... 170
The Legal dimension of Science, Technology & Innovation Policy .................................................. 171
National Information Society Councils/Institutes ............................................................................. 171
Mapping of local actors ...................................................................................................................... 174
Involvement of private actors in biotechnology .............................................................................. 175
Workshops on policy making ........................................................................................................... 176
The 2006 Cairo Conference ............................................................................................................... 177
Crisis management: a public - private initiative for the fight against the “Tobacco Streak Virus”... 179
Dialogue and consensus building in the field of forestry technology ............................................. 182
The participation of stakeholders in rural projects .......................................................................... 182
Self-organisation of citizens in water management ......................................................................... 184
Lessons Learnt on Substantive Approaches: Kenya ................................................................. 230
Lessons Learnt on Substantive Approaches: India............................................................... 230
ABOUT SET-DEV PROJECT

The European Commission – DG Research has funded under the Seventh Framework Programme of Research and Technological Development a Coordination Action on “Science, Ethics and Technological Responsibility in Developing and Emerging Countries” (SET-DEV) (Grant Agreement n. 217811), started in March 2008 and lasting 36 months. The Coordination Action was aimed at supporting the research systems of two countries – India (as an emerging economy) and Kenya (a developing country) – in order to enhance the position of scientific and technological research (STR) in society, i.e. to promote its socialisation.

The project was intended to confront the ethics and science issues within the broader framework of science-society relationships, with a view to encourage various social actors to assume greater responsibility toward STR.

The project was carried out by a consortium made up of the following Indian, Kenyan and European entities: Consiglio Nazionale delle Ricerche – National Research Council of Italy (consortium coordinator); Laboratorio di Scienze della Cittadinanza (LSC) – Laboratory of Citizenship Sciences; Maastricht University; Minerva Consulting & Communication Sprl.; University of Central Lancashire (LBS and CLICT); African Technology Policy Studies Network (ATPS); Department of Sociology, School of Social Sciences, University of Hyderabad; Lund University; Centre for World Solidarity (CWS); Intermedia NCG; Max Delbrück Centre für Molekulare Medizin (MDC).

To attain its aim the project, through a set of activities of coordination, research, capacity building, dissemination and awareness building carried out in India and Kenya, pursued the following specific objectives:

- to strengthen the levels of information about and awareness of critical issues connected to science and technology by fostering a dialogue among scientists from different parts of the planet (Europe, India and Kenya, but also from other geopolitical areas);

- to enhance the socialisation of research, with particular attention paid to the factors, both national and international, that can facilitate or, on the contrary, hinder the development of scientific and technological research (STR) systems (legal frameworks, training systems, etc.);

- to activate the processes of building institutional capacities and skills in science, ethics and STR socialisation in leading to greater collective responsibility towards research processes (technological responsibility);

- to develop measures and guidelines that are sensitive to local values and needs and compatible to the characteristics and the degree of development of local research systems;

- to define perspectives of socialisation of science and technology that take into account local needs in a multilateral dialogue which includes EU approaches about research, innovation and development.

1 Due to circumstances arising during the course of activities, the duration of the project was extended to 39 months, until May 2011, as requested by the CNR in the Attachment Request for amendment No 2, Grant Agreement No 217811, project title "SET-DEV", 21st December 2010.
To attain its objectives this project has implemented an itinerary that consisted of 12 Work Packages and included the following activities: producing knowledge on STR in India (with a particular focus on Andhra Pradesh) and Kenya; supporting dialogue among research networks from Europe, India and Africa, by means of two “Manifestos” (for India and Africa respectively) on the relationship between ethics, democracy, science and development; conducting two pilot programmes in India and Kenya focused on public dialogue and capacity building actions on STR socialisation themes; promoting meetings and seminars on science and ethics and on legal aspects of technology (particularly the relationship between privacy and the Internet); set up a joint programme aimed at promoting multilateral dialogue among the partners and to identify elements of sustainability for the project; preparing and disseminating guidelines on these issues.

The SET-DEV web site is: www.set-dev.eu

During the work on the Manifesto, it was realized that its perspective should be extended from Kenya to the entire African continent to give the initiative greater breadth and impact.
Acknowledgements

The Guidelines summarise the experience of all the activities carried out during the three years of SET-DEV and are based on intense three-way dialogue between its partner organisations in Africa, India and Europe, as well as many other national and regional participants. Special thanks go to all of them.

The work on the design and preparation of these Guidelines was coordinated by LSC, involving, in different ways, all SET-DEV partners.

In particular, the Guidelines were edited by Daniele Mezzana (LSC), with the support of an editorial board involving Alfonso Alfonsi (LSC), Wiebe Bijker (Maastricht University), Haribabu Ejnavarzala (University of Hyderabad), Kevin Urama (African Technology Policy Studies Network - ATPS), Wendy Taylor (Intermedia NCG), Shambu Prasad (Centre for World Solidarity and KICS). Other SET-DEV partners were actively involved in reviewing, amending and validating the document, namely: Andrei Kuznetsov (University of Central Lancashire - LBS) (to whom goes especial acknowledgment also for his very detailed and insightful work of linguistic and conceptual revision); Joe Cannataci (University of Central Lancashire - CLICT); Axel Carlberg (Lund University); Nagalakshmi Chelluri (University of Hyderabad); John Fox (IntermediaNCG); Wairimu Mwangi (African Technology Policy Studies Network - ATPS); Hinano Spreafico (Minerva Consulting & Communication Sprl.); Filippo Vinciguerra (Consiglio Nazionale delle Ricerche - National Research Council of Italy).

The process that led to these Guidelines is described below.

After the second SET-DEV steering committee meeting held in Nairobi in May 2009 LSC staff set up a facility to collect information and documents on the project’s various ongoing activities. In parallel, information, comments and suggestions were also collected in direct interactions with the project partners, both during specific meetings (seminars, workshops, etc), and during interviews by LSC staff, from May 2009-April 2010. In April 2010, the first draft of the structure of the Guidelines was produced, based on the analysis of the collected documentation. This draft was sent to all partners and discussed with them directly by means of electronic conferences via Skype, which took place in April-May 2010. In this way, many suggestions were received and used as a basis for a more detailed project of the Guidelines. It contained indications about the aims, structure and content of the Guidelines, and some proposals on the division of tasks among the partners and the timetable to be followed.

This project was presented at the Third Steering Committee, held in Rome in June 2010. The general outline of the project was approved and work was started for a first draft of the text. The editorial work was completed in January 2011.

---

3 In this case, of particular value were the missions of the LSC staff, such as the one in February 2010 (in which Daniele Mezzana met the managers of the Pilot programme in India and especially the case study supervisors, attended the Hyderabad conference on the programme "Ethics and socialisation policy-development in technology-driven rules" and met the Bengaluru focus group on Climate Change) or those involving Alfonso Alfonsi, who participated in many meetings and seminars organised by the Indian, Kenyan and European partners.
The first draft of the Guidelines produced in this way circulated among the partners and several experts not involved in the project, for review and validation, namely: Leena Abraham (Tata Institute of Social Sciences, Mumbai); Dinesh Abrol (National Institute of Science, Technology and Development Studies, New Delhi); Stefano Ciccone (Parco Scientifico, Università di Tor Vergata, Roma); Iqbal Javed (Institute of Life Sciences, Hyderabad); Atieno Ndede-Amadi (Kenya Country Business Incubator, Nairobi); Marzia Mazzonetto (ECSITE, Brussels); Abel Nyakundi Mayaka (Moi University, Nairobi); Ruth Oniang’o (Rural Outreach Program, Nairobi); David Otwoma (National Council for Science and Technology, Nairobi); Pakki Reddy (Agri Biotech Foundation, Hyderabad). Following this procedure, the editorial staff incorporated the suggestions received from the reviewers and produced this final version of the document, to be submitted, along with the other main project outputs (in particular the two Manifestos), at three seminars held in March – April – May 2011 in Hyderabad, Nairobi and Brussels, and published on the Internet.
**Introduction**

These guidelines are the result of dialogue and cooperation between representatives of three major scientific cultures of the contemporary world: European, Indian and African. For this reason, this document can provide some indications about the development of scientific and technological research (STR) on our planet. In particular, the Guidelines are intended to be a practical contribution about how we can promote effective collective responsibility in science and technology. In doing so, this text will offer some information, based on the SET-DEV three-year experience, on the social fabric of science, and some suggestions on how scientific and technological research can better integrate into society and be more relevant to society’s needs.

Below we briefly summarize the objectives, the target, and the structure of the Guidelines, as well as the theoretical and methodological frameworks that underlie the document, and the “how to use” it.
OBJECTIVES AND TARGET

The present Guidelines are one of the public outputs of SET-DEV project. They are complementary to and integrated with all other outputs, above all with the *African Manifesto for Science, Technology & Innovation* and the *Knowledge Swaraj: An Indian Manifesto on Science and Technology*.

The objectives of the Guidelines are as following:

- raising awareness of the importance of socialisation of STR for the progress of local research systems;
- increasing the capacities of the concerned actors (governmental and non-governmental agencies at the national and local level) involved in STR policies through defining, implementing and evaluating measures for strengthening a collective responsibility for STR;
- providing a practical guide how to increase the socialisation of STR in order to energise programmes in this field run by individual research and higher education institutes and by others social and professional actors.

The Guidelines are addressed to national institutions responsible for science and technological innovation policies; university rectors, directors of higher education and research institutions; national and local agencies supporting innovation; international and regional organisations; leaders of professional associations and scientific societies; national bodies for the evaluation of scientific and technological research; social partners, civil society organisations and their networks; private actors and their R&D facilities and networks; international, national and local media.
STRUCTURE OF THE GUIDELINES

The Guidelines consist of eight chapters, as well as this introduction.

The eight chapters refer to several areas of STR socialisation (scientific practice, scientific mediation, scientific communication, etc.) that is critical areas in which actors involved in STR "construct" the relations between science, technology and society (see below).

For each of these areas several frames of responsibility are outlined which act as reference points for identifying problems and finding solutions concerning the relationship between science technology and society.

For each of these frames of responsibility a set of practical options (a sort of a “catalogue” of options, based on SET-DEV experience of study, dialogue, exchange, and practice) is developed for all concerned actors to consider, choose from and adapt to their own contexts.

The frames of responsibility and practical options (even if formulated in reference to SET-DEV experiences in India and Africa) may have a general significance outside these contexts. To provide specific suggestions for Indian and Kenyan readers, some lessons learnt were also formulated, for each area of socialisation of STR. Some general lessons learnt were formulated too from the point of view of European partners, and placed in the Appendix.

A bibliography completes the document.
THEORETICAL AND METHODOLOGICAL FRAMEWORK

- **Changes in Science and Society and the Socialisation of Scientific and Technological Research**

Underlying these Guidelines and SET-DEV in general is the perception that, albeit in different ways, in all countries on our planet scientific and technological research (STR), while producing great practical results, remains, paradoxically, at the periphery of economic and social development, and, therefore, risks to remain extraneous to the societies in which research is carried out or applied. The various aspects and the many consequences of this situation, as well as possible solutions to associated issues, are at the centre of the Guidelines.

To clarify the reasoning behind the Guidelines, this section summarises the main elements of theory of socialisation of STR. This theory has its roots in sociology and was developed at the beginning of the last decade in the context of a number of research programmes, some of which were carried out with the financial support of the European Commission (d’Andrea, Quaranta and Quinti 2005; Bijker and d’Andrea 2009; Cacace 2009). The purpose of these research programmes was to better understand the embeddedness of scientific and technological research in European societies as well as the reasons for the many difficulties in obtaining adequate legitimisation and support that STR faced in Europe. Later this theory has expanded to encompass other parts of the world, as in the case of the SET-DEV project.

This theory starts with the assumption integration of research into society fails to keep pace with advances in research as many STR actors find it difficult to face up to some profound changes in research and technology that have occurred in the last decades. Such changes concern primarily the so-called ‘post-modern’ societies, in which knowledge has become a crucial factor of economic life and in which individuals and groups are gaining more and more weight vis-a-vis institutions (Lyotard 1984; Beck 2002; Giddens 1991).

Socialisation theory is also influenced by dramatic changes just in the ways in which science is produced. Until a few years ago, science was essentially governed by the interests of the scientific community, was divided into distinctive disciplines, involved actors who shared a similar culture and belonged to the same type of institutions, was prevalently based on hierarchical relations, and generally was not very much transparent. For some time now we have instead been witnessing a number of changes, which have been interpreted on the whole as the shift to a new mode of science production (that some authors call it “mode 2”) (Ziman 2000; Nowotny, Scott, Gibbons 2003). This change includes an increase of demand for a better contextualisation of STR with regard to the different human realities, as well as for a greater application of research results for innovation (Khan et al., 2008; Urama, Mwendela 2005). We are also witnessing an increased role of actors – public, private and non profit – external to the scientific ‘establishment’, but who have an increasingly important role in orienting the research and its products (Prasad 2005), together with a demand for the democratisation of the debate on STR policies (as in the SET-DEV “Manifestos”). These changes result in blurring boundaries between fundamental, strategic and applied research; growing demand for transdisciplinarity; emergence of new functions and professions in areas such as communication, research management, project design and others.
This is the context, which highly industrialised countries, emerging economies and developing countries all share to a certain extent. As a result the foundations, operational modalities and social positioning of scientific and technological research – despite its centrality for economic and social development – is often put into question and tends to be perceived as a sort of “foreign body” in societies.

Hence STR faces the challenge of integrating in society. This involves two types of social processes which are already under way:

- **adaptation** to the needs and expectations of society and of its members;
- **search for identity**, here understood in sociological terms as the ability of STR to exert a greater control over itself and over the social dynamics (in broad sense, including political, cultural, organisational, or communication ones) increasingly embedded in the research (Luckmann 1982).

The socialisation of STR is not to be regarded as a unitary and linear process, but a composite and multidirectional one. In order to study it, a constructionist approach has been followed by this team, inspired by many contributions that have been produced in the last decades on the social construction of science and technology (Bloor 1976; Latour, Woolgar 1987; Pinch, Bijker 1990; Bijker 1995). The objective was to identify the areas in which actors involved in STR “construct” relationships between science, technology and society, both on the “adaptation” side and on the “identity” side. These areas are named here the “areas” of STR socialisation.

### The areas of STR socialisation

The eight areas of STR socialisation referred to in SET-DEV are briefly described below. Needless to say these areas are strongly integrated among each other, with some possible overlaps.

**Scientific practice**

The profound changes which occur in science and technology have many manifestations. They influence the manner in which science is understood and applied. There is now a stronger linkage between science and technology and between pure and applied research. Research more and more bears the features of transdisciplinarity. Economic exploitation of scientific results is greater than ever, as well as accountability and transparency of research and linkages with “external” actors. All this contributes to modifying the social environment of research. Research teams in different institutes have become, in a certain sense, the basic units of knowledge production. They are at the core of the increasing dynamism of scientific research and at the same time are challenged by it.

This first area of STR socialisation thus concerns research practice conducted by research groups in the strict sense, as well as the pressures and opportunities faced by these groups. A number of issues can be identified to this respect, concerning, for example, the management of changes in the way knowledge is produced (especially at the cultural and professional levels); the social and economic status of researchers; the relationship between administrative and management tasks and research work; the control of research quality; the collaboration between different disciplines; the identification of research priorities; access to publishing opportunities; training and career development for young researchers; how to reward merit; external influences on the research world.
A question of fundamental importance here is that of the "contextualisation" of scientific research in the sense of its adaptation to local needs and cultures. This should be reflected in an attitude to recognise and enhance the socio-cultural diversity of researchers – across classes, casts, gender, ethnic groups, etc. – in scientific institutions. This involves, among other things, as highlighted by Knowledge Swaraj: An Indian Manifesto on Science and Technology, another SET-DEV output, recognizing the pluralistic nature of the expertise and knowledge involved in research, including the know-how of local stakeholders, some of whom may come from the poorest and most marginalised social groups.

**Scientific mediation**

Research activities are becoming increasingly complex. For this reason they call for broad and sophisticated management, coordination, promotion and programming skills, which researchers alone cannot achieve unless they take precious time and energy from their research work. In this sense, it is possible to identify a specific area of STR socialisation, which includes the various forms of “scientific mediation” aimed at promoting or facilitating a productive cooperation among researchers and other key actors inside and outside their research institutions. This may happen, for instance, by improving environmental and organisational conditions in which researchers operate, reducing the administrative activity burden involved in research and fostering the cooperation among different institutions.

With respect to ongoing transformations in science and technology, it is possible to identify operationally five domains of scientific mediation:

- **Governing and managing**, including all aspects of the social environment related to management, administration and planning in research institutions, power relations in research institutions and political relations of any kind;
- **Teaching**, including relations referring to certain types of development of teaching activities following the emergence of new needs and tasks, for instance, teaching are more connected to specific production needs;
- **Networking**, including sometimes problematic relations linking scientists and research groups to their community, namely economic actors and enterprises, civil society organisations, professional organisations, social services, local authorities, science centres, intellectual networks, local medias and high schools, as well as scientists belonging to different organisations;
- **Designing and promoting**, This concerns the design and promotion of new research programmes and projects in the context increasingly competitive access to funding;
- **Managing knowledge** - includes the production, exchange, dissemination, manipulation and transfer of scientific knowledge.

Scientific mediation thus represents another important area of STR with such specific issues as managing bureaucratic and administrative aspects of research; fund raising for research; research design; efficiency in the use of the institutions' resources; inter-institutional relations; human resources management.

**Scientific communication**

Scientific communication is another important area of socialisation of STR by virtue of the growing complexity of science and technology production and science-society relations. STR, one could say, is a real “collective enterprise” that can work only by involving a broad set of actors - researchers, politicians, public administrators, disseminators, enterprises, the media, etc.
This collective effort requires extended and widespread communication between all parties involved that operates at many different levels and is no longer limited to the traditional forms of science dissemination. Scientific communication may include communication among researchers belonging to the same disciplinary domain or research sector (“intra-epistemic” communication); communication between actors coming from different disciplinary domains, often operating in non-academic institutions (“trans-epistemic” communication); “network” communication involving the actors engaged in auxiliary activities with respect to research (managers, evaluators, designers, technical and administrative staff, etc.); “social” communication, in which social groups, associations, companies, etc. develop their contribution and their proposals for shaping scientific knowledge; “political” communication, involving relations between scientific communication and decision-makers; “general” communication concerning the relations between the scientific community and the public opinion.

Scientific communication as a whole can be understood not only as an instrument of dialogue and dissemination, but also a tool that allows building a higher and more widespread responsibility towards research among different social and political actors that have a particular vision of science and technology and, accordingly, a particular attitude or agency towards STR governance. Themes related to STR socialisation of scientific communication include, for instance, overcoming disciplinary and/or organisational isolation of researchers; the (central or marginal) role of research in social life; views of STR by public opinion; the most adequate forms of public debate on STR and its economic and social impacts; the adequacy of science dissemination activities; the capability and will of researchers to dialogue with other social actors; the role of the media in depicting STR.

**Evaluation**

A fourth area of STR socialisation is the evaluation of science and technology. The role of evaluation grows due to increasing attention that members of society pay to knowledge production, knowledge application and the assessment of the impacts of such application. In this context practices, programmes and measures aimed at ensuring accountability in the world of research are becoming increasingly widespread. At the same time there is broadening of the scope of evaluation to include also objects that traditionally were given little consideration, such as research management, exploitation of STR results, scientific communication, science and technology policy, interaction between university and industry, etc. All this makes evaluation an important instrument both of designing and implementing various types of action, as well as of coordinating the allocation of research funds. In addition, the evaluation activity may be seen as an important learning process for all actors that are involved in it.

In reality, the potential of evaluation remains mainly underutilised. Among the key issues there are, for example, the slow pace diffusion of the evaluation culture; the still restricted domains in which evaluation is applied; the type and degree of control exercised on the quality of the various aspects of research; ways in which stakeholders can participate in evaluation; the link between evaluation and decision-making; the investments that are necessary to implement evaluation programmes; the transparency of fund allocation criteria and the recognition of merit and excellence; the adequacy for the specific national contexts of the instruments for evaluating quality and scientific productivity that are used at international level.
**Innovation**

Innovation, here considered in broad terms as the use of scientific and technological research results to foster social and economic development, is another key element of STR socialisation. This concerns in particular the interactions between research and the world of production, which are a privileged channel for innovation processes. Such processes also include the economic, social and cultural impacts connected to science and technology, induced or not by policy programmes, measures or actions.

Innovation processes are not linear or easily controllable. They involve various types of actors (researchers, entrepreneurs and farmers, civil society organisations), each one having representations of reality, attitudes and expectations that are not always easy to reconcile with each other and may also belong to different conceptual and epistemic worlds. Thus STR socialisation as far as innovation is concerned may have at least two sides: socialisation of research institutes to innovation and socialisation of enterprises and civil society organisations to research. Themes about STR socialisation in this domain may include: social dialogue between the research and the production worlds on science and technology; the acknowledgement of the importance of innovation by the academia and by the research world in general; the overcoming of cultural, linguistic and organisational barriers between university and industry; the updating of university curricula with innovation-related topics; the involvement of civil society organisations in research-based innovation; the establishment of a financial, legal and organisational context which is conducive for innovation; the social and economic appropriateness of research and technology transfer.

**Governance**

Changes in the relations between science, technology and society require forms of governance of science and technology that are more relevant to the new mode of production of science and open to the involvement of citizens as recognised stakeholders. The notion of governance here is understood as a set of structures and processes for collective decision-making, involving both governmental and non-governmental actors.

Governance mechanisms are expected to balance necessity to strengthen science-led innovation with growing demand for democracy in science-related policy-making. Moreover, governance may have at its core problematic aspects such as the regulation of the commercial and privatisation drivers, the management of the STR policy agenda, the definition of priority research domains and related funds, the implementation and monitoring of policies, the management of international relations and interferences on national policies and many more. Governance may be considered an important area of STR socialisation. It is a complex process, both from the institutional and cultural point of view, and requires a constant search for the most adequate modalities for taking decisions on such a sensitive subject.

The *African Manifesto for Science, Technology & Innovation*, compiled under the auspices of SET-DEV, stresses the importance of promoting and supporting a new and participatory leadership for the governance of this area, with leading roles being played by national and local actors, as well as by pan-African and international stakeholders. For its part, the *Indian Manifesto on Science and Technology*, which aims to recognise the plurality of expertise and knowledge, highlights the theme of democratisation in the debate on science and technology and research agendas.

**Gender**

Another important area of STR socialisation deals with gender issues in scientific activity. Here three open problems need to be addressed: science as an unfriendly environment for
women in which a hidden structure of discrimination can often be found; science as a gender-insensitive domain (persistence of gender stereotypes identifying science and technology with masculinity, thus risking to lose a fundamental contribute in terms of styles of thinking, visions, fertile imagination and sensibility); the under-representation of women in scientific leadership4.

Among recurring problems the following merit to be included in this area: gender "vertical segregation" which hinders the access of women to top positions in science careers; "horizontal segregation" that points to the uneven concentration of women and men in different scientific domains along gender lines (e.g. women are especially under-represented in "hard" sciences); the "male oriented" organisation of career paths; the difficult reconciliation of work and family responsibilities for women researchers; the diffusion of stereotypes and cultural constraints referring to gender; the gender bias in knowledge production, and so on.

In fact in India and Kenya, as well as in Europe, gender issues in science appeared particularly salient. The decision to identify and analyse this area is not to be interpreted as a consequence of considering gender as a sectoral issue; quite on the contrary, it is the result of deeming it a crucial area for the construction of STR as a whole by research actors.

**Substantive approaches**

There is another area of socialisation that was considered especially relevant to the objectives of SET-DEV. In the course of investigating the relationship between science, technology and society in countries with emerging economies or in developing countries a key area of STR socialisation clearly presents itself. It incorporates various aspects influenced by how knowledge stakeholders in these countries position themselves vis-à-vis western science including the peculiarity of national research systems in comparison to those of Western countries; the weight of autochthon scientific traditions, philosophies, spiritual systems and thought paradigms. This area thus refers to the presence of what could be termed "substantive" approaches, that is, those approaches envisaging a revision of the epistemological, philosophical and cultural foundations of science, on which a critical vision of western science can be drawn. Moreover, substantive approaches are oriented to protect local forms of knowledge and use it to advantage5.

In this area the following issues may be seen as potentially problematic: risks related to purely imitative approaches in policies and practices in the field of STR; relationship between western science and traditional and/or local forms of knowledge; protection of indigenous knowledge; existing perception of science and technology in the framework of national or local philosophical, religious and ethical traditions; promotion of self-reliance; existence and/or the perception of an "added value" of one’s national research system, when involved in exchange and international cooperation policies; relationship between tradition and modernity.

Here, too, the two "Manifestos" developed as part of SET-DEV in India and Africa strongly underline these issues, by calling everybody’s attention on the importance of recognising cultural diversity and different kinds and styles of knowledge, the plurality of scientific imaginations, and the democratisation of the debate on science and technology.

---

4 In this regard, it is appropriate to consider the outcome of recent research “Practising Gender Equality in Science” (Cacace 2009) conducted in Europe on gender issues in scientific activity, which uses the theory of STR socialisation. See also Harding 1998.

Together the areas described above represent a taxonomy of the domains in which STR socialisation processes can take place as processes of construction of the relationship between science and society which allow to detect phenomena which otherwise may be overlooked or not grasped in their entirety. It is important to note that by their very nature these areas are not rigid and inevitably somewhat overlapping.

For each of these areas one can identify:

- "structural" phenomena, referred to existing social structures the actors cope with (manifesting themselves through social norms, behavioural models, social roles, values, etc.), and related obstacles or facilitating factors;

- "agential" phenomena, referred to the actors and their agency, that is, to their orientation to modify reality, which can translate itself into specific practices.

Through the approach of STR socialisation it is possible to outline a profile of relations between science, technology and society in a given country, with the possibility to provide information on relevant situations, critical aspects, risks, paradoxes and opportunities. In this sense, this approach - which is complementary to other theories of the social dimension of science and technology - can be used to understand some aspects of social reality in emerging and developing countries in terms of the relationship between science, technology and society. Moreover, through the study of socialisation of STR it is possible to grasp emerging phenomena and social processes which are taking progressively shape.

The analytical distinction between different areas of STR socialisation, moreover, allows us not only to grasp more clearly the different risks and different opportunities that exist in the relationship between STR and society, but also to identify different policy intervention "fronts". This analysis can be used as a knowledge base for targeted action (when necessary), and to coordinate and create synergies in this field.

This approach is capable of reflecting the considerable complexity and multidimensionality of the relationship between science, technology and society. However, in order to achieve this, it has to be adapted to different national and social contexts.

---

6 In the case of SET-DEV, this involved, for example, the introduction of the "substantive approaches" area, which was not present in other previous applications in Europe.
A new local and global responsibility

In view of what was said above, it is clear that a poor adaptation of STR to social contexts and an inadequate control of transformations affecting research can favour the occurrence of the so-called "technological drift". This term describes the situation when society increasingly depends on science and technology produced elsewhere, without possessing the capacity to handle, adapt, modify and develop its own science and technology or to steer their use. Consequently, societies face the perspective of reducing their options to imitating the models of growth that may have been developed in a different context and therefore are suboptimal in terms of their contribution to national development.

To confront this risk, in India and in several African countries as well as in other societies worldwide, new strategies and policies are being proposed and put to the test. Some of them have been investigated in the framework of SET-DEV project in India and Kenya. From these and other actions emerges a strong and conscious policy action and the rise of a collective responsibility (one may call it technological responsibility) towards the management and guidance of STR. This is attested also by the Indian and African Manifestos, that represent, together with these Guidelines, the main outputs of SET-DEV project: they call for a stronger contextualisation of science, technology and innovation, and for a more participatory management of the policies and projects in this field.

The technological responsibility concerns, in different ways, all actors involved in STR: the researchers themselves, managers and directors of research institutes, national and local decision makers, trans-national organisations and international cooperation, entrepreneurs and business associations, civil society organisations, networks and support and counselling services, the media and many others.

Now, with the growth in importance of science and technology as crucial development factors, the question arises if a new and special class of rights (and related duties and responsibilities) is emerging also in the knowledge area. These rights may concern aspects ranging from stakeholder involvement in defining policy agendas on science and technology up to the participation of beneficiaries in technology transfer, the protection of intellectual property (including the traditional and indigenous one) and above all a complex of rights, duties and responsibilities concerning the generality of citizens. This has to do with what has been called scientific citizenship (Quaranta 2007). In the perspective of technological responsibility suggested above, and if one considers knowledge linked to the dimension of rights and a common good to be preserved, enhanced and exploited to the benefit of all, then the distinction between scientists and lay people, experts and non-experts, no longer makes much sense. It seems more meaningful to speak of a dimension of common citizenship built around "knowledge", explicated through the exercise of joint responsibility, although at different levels, by the various types of actors.

This exercise of responsibility can have a local, national, and global scope. The innovations produced by STR are, for better or for worse, factors that deeply affect the life of whole communities. This influence is even more significant on a global scale where knowledge in its various manifestations has become the key element not only in the economy, but in actual social interactions and in international relations (Castells 1996; Felt 2007).

Currently the prevalent scientific paradigms, practices, representations and policies are historically loaded with "western" (often gender biased) worldviews, styles of thought and criteria for choosing priorities for research. At the same time, some of the countries that are raising in importance in the global scientific and technological arena come from outside the "western" sphere, making it all the more necessary to better understand how this could in-
fluence the development of science and technology. This increases the importance of STR socialisation not only for individual societies, but also for the "global ecumene" (Hannerz 1992), to re-legitimise it in a plural world where all sorts of differences interact and mix.

This situation requires that the topic of STR socialisation receives consideration from various cultural and epistemological perspectives. The multilateral dialogue on STR and its relation to society, which has characterised the SET-DEV project, has tried to follow this path.

- **Frames of responsibility, practical options, lessons learnt: how to use the guidelines**

As is clear from what has been said so far, it is from the standpoint of collective responsibility for STR that the SET-DEV project interpreted the relationship between ethics and science.

Following the above approach, the SET-DEV activities and outputs were analysed to see if guidelines could be formed to improve the relationship between science, technology and society through greater accountability of the political, social, and economic actors and, of course, researchers themselves.

To do this, we tried, first, to identify in all the documentation produced by the project partners (see below) and for each of the eight STR socialisation areas the major recurrent risks for both society (in its relationship with research) and for research itself. By grouping these risks together (as coherently as possible and with some degree of conventionality), a series of frames of responsibility (FR) were identified, regarding, for example, a dialogue between researchers and citizens, democratisation of S&T decision making, research infrastructures, the relationship between modern science and other forms of knowledge, etc.

By frame of responsibility we mean a set of risks and challenges for STR and its relationship to society, for which it is essential to take a stand, make a commitment (at a personal ethical level and as regards the choices of the community) and especially to act in terms of strategy, policies and concrete actions on the ground. By identifying and formalizing a frame of responsibility we can find solutions that make sense for the relation between science, technology and society.

The frames of responsibility outlined here are not systematic or exhaustive in character, nor are they prescriptive. They emerged from the tri-lateral dialogue, and concern, albeit in different ways, India, Africa and Europe.

For each of the frames of responsibility a set of practical options (PO) was also identified. A practical option is a concrete action that can be taken to strengthen science and technology in its relationship with society. All the practical options proposed were either implemented and tested by SET-DEV partners in their own activities, or observed by them while imple-

---

7 The relationship between ethics and science has, of course, many aspects, ranging from the shared values that regulate scientific activity and its relationship with society to the rules that can determine specific codes and protocols, ethical dilemmas concerning the options involved in specific situations, and different types of individual, group and general responsibilities involved in scientific and technological research. These various aspects were taken into account in different ways in the SET-DEV project, whilst adopting the general perspective of collective responsibility in STR.
mented by third parties, or reported in literature as significant. Although the practical options outlined here are not exhaustive or systematic, SET-DEV partners believe that they could have significance beyond the contexts in which they were identified and formalised. For all these reasons, they are presented in the form of a "catalogue" (admittedly limited and with a degree of repetition or overlap).

As said before, while frames of responsibility and practical options (even if formulated in reference to SET-DEV experiences in India and Kenya/Africa) may have a general significance outside these contexts, some specific lessons learnt were also formulated by Indian and Kenyan partners for the Indian and Kenyan readers, for each of 8 areas of STR socialisation.

**STRUCTURE OF THE GUIDELINES**

The reader is invited to take from this document what is useful for him/her to better understand the relationship among science, technology, innovation and society, adapting the frames of responsibility, the practical options and the lessons learnt in his/her specific geographical, political, institutional, cultural, social, economic, organisational context.
THE SOURCES OF THE GUIDELINES

These Guidelines are one of the central outputs of the trilateral dialogue (Kenya-Africa/India/Europe) which took place as part of SET-DEV and focused on types of collective responsibility in science and technology.

The main source of the Guidelines was the documentation produced by SET-DEV partners during the course of their activities, either separately or jointly, and which was made available to the editorial staff. This documentation included reports on various initiatives and their results. Another important source was academic and professional literature on the subject (see bibliography).

With regard to the sources within the project, the following deserve special mention.

- Knowledge Swaraj: An Indian Manifesto on Science and Technology: preparatory notes and papers plus the various drafts of the Manifesto which were discussed and fine-tuned in meetings and seminars held in India between 2008 and 2010, starting with the Workshop at the Adivasi Academy, Tejgadh, Gujarat (November 2008).
- African Manifesto for Science, Technology & Innovation: the preparatory notes and papers plus the various drafts of the Manifesto, which were discussed and fine-tuned in meetings and seminars held in Kenya (starting with a workshop in Nairobi in February 2009 to begin work on the Manifesto), Nigeria and Egypt between 2008 and 2011.
- Pilot Programme for India: the document Piloting Knowledge Swaraj: A handbook on Indian Science and Technology (draft of July 2010 and subsequent drafts), preparatory papers and interim reports of four case studies (concerning agricultural practices not involving pesticides, the democratic management of water resources, hysterectomy abuse in medical practice, appropriate technology in post-disaster reconstruction); workshops in Hyderabad in September 2009 and January 2010 on various aspects of the relationship between ethics and STR socialisation; the Bengaluru Focus Group on Climate Change in February 2010; the Hyderabad Focus Group Discussion on the Ethical Dimension of Communication in March 2010; meetings and interviews with case studies supervisors (see below); the workshop presenting the case studies (Hyderabad, April 2010).
- Pilot Programme for Kenya: the Guidance Note of December 2010 on STR case studies conducted in Kenya by Egerton University and the International Centre for Insect Physiology and Ecology (ICIPE); the interviews on case studies (May 2010) and preparatory materials; the report on capacity building workshops in Mombasa in July 2009 on various aspects of STR socialisation; the report of the Mombasa focus group on "Scientific communication in Kenya" (March 2010).
- Preliminary research on STR socialisation in India and Kenya: notes and minutes of interviews and focus groups held in India and Kenya at the end of October and

---

8 The quotations from the Manifestos refer to the advanced versions available at the moment of the drafting of the Guidelines.
beginning of November 2008, the final 2009 WP1 report, containing a first outline of STR socialisation in India and Kenya.

- Joint programme to facilitate dialogue among the tripartite partners and to identify elements of sustainability for the project: preparatory notes and papers; final reports.
- Programme on “Ethics socialisation and policy-development in technology-driven rules”: preparatory notes, papers and reports of two conferences held in Hyderabad (February 2010) and Nairobi (September 2010).

Additional sources for the Guidelines include inputs provided directly by the partners during seminars and personal interviews in the course of the project, as well as at the three meetings of the steering committee held in Rome in 2008 and 2010 and Nairobi in 2009.

The following activities, in which SET-DEV partners took part, were also important for the presentation and discussion of the two "Manifestos" and the content of SET-DEV in general: the annual ATPS conferences (Abuja, November 2009; Cairo, November 2010); the conference "Innovation, Sustainability, Development: A New Manifesto" in London (June 2010), organised by the STEPS Centre (Social, Technological and Environmental Pathways to Sustainability); the sJCOOP Project training workshop promoted by the World Federation of Science held in Turin (June-July 2010); the workshop “the Public Understanding of Science in Africa” in Nairobi (September 2010).

The documents collected were analyzed (in relation to the eight areas of STR socialisation) to identify aspects that could be useful for the preparation of the Guidelines, including: obstacles and facilitation factors; strategies; operational solutions; types of practices actually experimented. The information thus collected was catalogued in a database, then used as a source for drafting the Guidelines.

The lessons learnt were also based on a further study and distance exchanges involving SET-DEV’s partners in the three geographical areas.

For more information, please consult the project website www.set-dev.eu
GENERAL SUMMARY

Area 1 - Scientific Practice

Frame of responsibility 1:
Contextualisation of research

**Practical Options**

PO1: SENSITISING RESEARCHERS TOWARDS DIALOGUE WITH STAKEHOLDERS
PO2: PROMOTING MEETINGS AND EXCHANGES WITH CIVIL SOCIETY ORGANISATIONS
PO3: JOINT DEFINING OF RESEARCH OBJECTIVES WITH STAKEHOLDERS
PO4: DISSEMINATING PARTICIPATORY METHODOLOGIES
PO5: SENSITIZING RESEARCHERS TOWARDS DIALOGUE WITH DISADVANTAGED SOCIAL GROUPS
PO6: MAPPING AND ENHANCING LOCAL EXPERTISE

Frame of responsibility 2:
Quality of Research

**Practical Options**

PO7: REDUCING BUREAUCRATIC AND ADMINISTRATIVE BURDENS FOR RESEARCHERS
PO8: PRODUCING GUIDELINES ON RESEARCH QUALITY
PO9: PRODUCING INDICATORS OF SCIENTIFIC MISCONDUCT
PO10: CREATING SELF-REGULATORY SYSTEMS
PO11: INTRODUCING THE ETHICS OF RESEARCH INTO ACADEMIC DIDACTIC PROGRAMMES

Frame of responsibility 3:
Researcher’s Identity

**Practical Options**

PO12: PROMOTING AWARENESS AMONG RESEARCHERS ABOUT NEW MODE OF SCIENTIFIC PRODUCTION AND RELATED RISKS AND OPPORTUNITIES
PO13: FOSTERING THE SOCIAL AND ECONOMIC STATUS OF RESEARCHERS
PO14: PROVIDING INCENTIVES FOR RESEARCH ACTIVITY
PO15: PROMOTING SCIENTIFIC EXCHANGES AMONG ENTITIES WITHIN THE UNIVERSITY AND WITH OTHER UNIVERSITIES/CENTRES AT THE NATIONAL LEVEL
PO16: PROMOTING ACCESS TO TRANSTATIONAL STRUCTURES TO OPTIMISE RESEARCH
PO17: PROMOTING THE PARTICIPATION OF INSTITUTES AND RESEARCHERS IN TRANSTATIONAL NETWORKS FOR SCIENTIFIC EXCHANGE
Frame of responsibility 4:
Generational change

Practical Options
PO18: Providing structures or functional roles within research institutes focused on recruiting young researchers
PO19: Assuring support services for young researchers
PO20: Monitoring careers
PO21: Promoting forms of support and scientific qualification
PO22: Supporting scientific publications by young researchers

Lessons learnt Kenya
- A multi-disciplinary and participatory approach to scientific practice is fundamental to the STR socialisation process
- The current focus of STR should be enhanced and broadened
- Greater coherence, coordination, and cooperation amongst the numerous organisations involved in STR/STI is needed
- There is a need for greater equality between local researchers and their international counterparts

Lessons learnt India
- The need for an increased interaction between the researchers, stakeholders and the CSOs.
- For research funding, there is a need for decentralisation.
- There is a need to foster the quality of the research, by evolving guidelines, regulatory systems, reducing bureaucratic burdens on researchers and other tools.
- Improving the social and economic status of researchers is necessary.

Area 2 - Scientific Mediation

Frame of responsibility 5:
General management and administration of research

Practical Options
PO23: Institutionalise the role of science manager in research institutes
PO24: Introducing awareness-raising courses and seminars for officials and researchers on management and organisational culture
PO25: Training or refresher courses for administrative and technical staff
PO26: Strengthening of the organisational units of research institutes
PO27: Establishing of managing positions responsible for creating and maintaining a favorable work environment
Frame of responsibility 6: Knowledge management and circulation

Practical Options

PO28: Creating or strengthening facilities like resource centres and libraries
PO29: Training of personnel devoted to knowledge circulation and management activities
PO30: Creating specific tools to collect and disseminate information on researcher expertise and activities
PO31: Creating opportunities for publications in journals
PO32: Creating opportunities for horizontal interaction among researchers of the same research institute
PO33: Establishing of consultancy offices or roles to advise researchers on critical issues

Frame of responsibility 7: New teaching functions

Practical Options

PO34: Strengthening students support services
PO35: Creating or strengthening tutoring
PO36: Creating or strengthening organisational structures for student participation in managing and evaluating didactic activities

Frame of responsibility 8: Territorial and international relations

Practical Options

PO37: Establishing roles and responsibilities for relations with local political actors and international cooperation agents
PO38: Establishing roles and responsibilities for relations with social actors
PO39: Establishing roles and responsibilities for relations with private actors
PO40: Matching services to facilitate meetings and partnerships with actors operating in specific sectors or intervention areas

Frame of responsibility 9: Research design for funding

Practical Options

PO41: Creation of offices to assist academics with research design and funding
PO42: Establishing the role of research design manager
PO43: Training or refresher courses on principles of research design for researchers

Lessons learnt Kenya

- There is considerable scope for local STR organisations to use the international hub provided by Nairobi
• There is further scope for building partnerships between overseas universities/research centres and locally-based organisations in relation to STR/STI

Lessons learnt India
• There is a need to improve management of research, in research information system in India, so that the R & D Institutions have access to information about research activities in other institutions.
• An awareness-raising activity for officials and administrators of management of research and R & D culture is needed.
• There is a need to establish institutionalised role of S & T managers in academia.
• Improving and creating opportunities for interaction among researchers working in similar areas on a regular basis is necessity.

Area 3 - Scientific Communication

Frame of responsibility 10:
Intra-epistemic communication

Practical Options
PO44: Promoting permanent structures for communication between researchers in the same discipline
PO45: Supporting researchers in publishing their work
PO46: Introducing new web applications and services

Frame of responsibility 11:
Trans-epistemic communication

Practical Options
PO47: Raising awareness among researchers about the importance and benefits of trans-epistemic communication
PO48: Creating common languages and environments to foster dialogue among researchers of different disciplines
PO49: Promoting multidisciplinary publications

Frame of responsibility 12:
Network communication

Practical Options
PO50: Experimenting with new forms of information exchange between researchers, management and administration
PO51: Organizing initiatives for interaction and dialogue between science managers and publishing managers
PO52: Strengthening communication with funding institutions
Frame of responsibility 13:
Social communication

Practical Options
PO53: Promoting opportunities for dialogue with stakeholders on the state of the art in key research sectors and the exploitation of research findings for the benefit of the community
PO54: Promoting forms of citizen consultation about priorities, dilemmas, risks and opportunities of technological options
PO55: Experimenting new tools to expand and democratise the debate on science and technology
PO56: Fostering programmes to “return” the results of scientific research to stakeholders
PO57: Promoting the dialogue on STR among local communities

Frame of responsibility 14:
Dialogue among decision makers and researchers

Practical Options
PO58: Promoting seminars and other forms of information exchange for policy makers and researchers
PO59: Sensitizing decision makers to the usefulness of research findings
PO60: Developing mechanisms to present research results to politicians
PO61: Establishing a national database of active researchers
PO62: Creating national agencies for the management of scientific communication policies

Frame of responsibility 15:
General communication

Practical Options
PO63: Promoting new approaches to scientific communication, besides PUS, among researchers and decision makers
PO64: Promoting initiatives for the dissemination of science, or extending initiatives already under way
PO65: Developing working tools and promoting meetings for science journalists
PO66: Promoting awareness of STR in schools

Frame of responsibility 16:
Researchers’ attitude to scientific communication

Practical Options
PO67: Raising awareness and training researchers to package findings
PO68: Creating places and occasions for researchers and journalists to meet
PO69: Disseminating new communication methods to involve different actors in the debate on STR
Frame of responsibility 17:
Relevance and accessibility of scientific communication

Practical Options

PO70: Promoting the study and implementation of scientific communication models relevant to different local cultures

PO71: Organising scientific communication initiatives aimed at reaching specific target populations

PO72: Using national and local languages for scientific communication

PO73: Identifying and spreading good science communication practices

Lessons learnt Kenya

- A multi-disciplinary approach to scientific communication is essential.
- For effective communication, there is a need to build reciprocal skills of scientists and non-scientists.
- For scientific communication to be effective, a focus on issues relevant to people’s lives is required.
- There is scope for applying innovative and interactive approaches to scientific communication.

Lessons learnt India

- Enhance and democratise the public debate on science and technology.
- Bridging the gap in recognising civil society experiences in the field of S&T.
- Involve CSOs as partners in knowledge production by the academics state and industry.
- Organise exchanges among researchers, decision-makers, journalists, civil society representatives and other stakeholders on the state of the art in key research areas.
- Improving and promoting initiatives to sensitise young minds on issues relating to the Science and technological responsibility at the school level and college levels.
- Improving practices regarding science communication among scientists and at undergraduate and graduate levels.
- Propagate working tools and meetings for science journalists.
- Co-ordinating work in the area of patent protection.

Area 4 - Evaluation

Frame of responsibility 18:
Dissemination of evaluation practice

Practical Options

PO74: Promoting the monitoring and evaluation of research plans and projects at any level

PO75: Raising the awareness of researcher of the best practice of evaluation
PO76: Foster decision-makers to allocate adequate funding for STR evaluation
PO77: Implementing programmes to support continuous assessment

Frame of responsibility 19: Quality of evaluation

Practical Options
PO78: Application of updated methods of evaluation
PO79: Production of evaluation manuals and guidelines
PO80: Developing shared evaluation criteria for STR policies
PO81: Harmonisation of different evaluation methods
PO82: Application of new accreditation methods towards research entities
PO83: Support of activities to promote post-accreditation quality
PO84: Benchmarking of good assessment practice

Frame of responsibility 20: Adaptation of evaluation

Practical Options
PO85: Involving stakeholders in evaluation
PO86: Developing and spreading contextualised evaluation methods
PO87: Developing ad hoc evaluation tools
PO88: Evaluating the specific impacts of the different technological options
PO89: Making use of locally available expertise for evaluation

Frame of responsibility 21: Transparency of evaluation

Practical Options
PO90: Defining public evaluation procedures
PO91: Creating commissions for an “ethical review” of research procedures

Frame of responsibility 22: Quality of evaluators

Practical Options
PO92: Ensuring transparency of the decision-making process as regards evaluation
PO93: Implementing programmes to identify and select qualified peers as evaluators

Lessons learnt Kenya
- Innovative and participatory approaches towards evaluation and impact assessment are needed
Lessons learnt India

- To improve the quality of evaluation, there is a need for application of new and updated assessment methods, manuals and guidelines.
- Enhancing the accountability of science and technology research evaluation (transparency, participatory approaches, etc.) is necessary.
- There is the need for fighting the scientific misconduct by evaluation bodies at national and local level, courses on ethics in universities, etc..
- There is a lack of methods to evaluate possible and probable risks arising out of impacts of S & D research.
- There is a need to create autonomous professional body for carrying out “Ethical review” of research procedures.

Area 5 - Innovation

**Frame of responsibility 23:**
Technology and knowledge brokering

**Practical Options**

PO94: Involving the bearers of local forms of knowledge in the identification of appropriate technologies

PO95: Fostering innovative and good practices

PO96: Expanding the use of pilot programmes

PO97: Establishing science and technology parks to promote collaboration between academia and business

PO98: Disseminating information on positive experiences in technological development at the national and local level

PO99: Encouraging exchanges among the beneficiaries of different technologies

PO100: Using mass media and the Internet to spread appropriate technologies

PO101: Enhancing networking with scientific and technological diasporas

**Frame of responsibility 24:**
Coping with technological plurality

**Practical Options**

PO102: Providing and evaluating technological options maps

PO103: Identifying and promoting “demand side” rather than “supply side” technologies

PO104: Involving local social actors in innovation programs

PO105: Setting up “learning alliances” with the participation of public and private actors, researchers, and civil society

PO106: Assuring respect for local cultures in promoting and regulating new technologies

PO107: Making use of local materials whenever possible
Frame of responsibility 25:  
Attitude of research institutes to innovation

Practical Options
PO108: CREATING MARKET ORIENTED RESEARCH AND EDUCATIONAL INSTITUTIONS, CENTRES AND NETWORKS
PO109: UPDATING ACADEMIC CURRICULA BY INTRODUCING THE ISSUES OF INNOVATION AND APPROPRIATE TECHNOLOGIES
PO110: INTRODUCING PROGRAMMES THAT MOTIVATE RESEARCHERS TO DEVELOP INTEREST IN INNOVATION ISSUES
PO111: PROMOTING EXCHANGES BETWEEN RESEARCHERS AND REPRESENTATIVES OF THE PRODUCTIVE WORLD

Frame of responsibility 26:  
Attitude of enterprises to innovation

Practical Options
PO112: SUPPORTING PRIVATE ACTORS IN PROMOTING RESEARCH
PO113: SUPPORTING PRIVATE ACTORS IN IDENTIFYING RESEARCH NEEDS
PO114: PROMOTING TRAINING IN SMALL AND MEDIUM-SIZED ENTERPRISES

Frame of responsibility 27:  
Promoting a research-based environment for innovation

Practical Options
PO115: SUPPORTING THE UP-SCALING OF POSITIVE LOCAL EXPERIENCES IN THE FIELD OF INNOVATION
PO116: IDENTIFYING AND AMENDING BUREAUCRATIC MECHANISMS WHICH MAKE INNOVATION MORE PROBLEMATIC
PO117: CREATING AND PROMOTING INFORMATION AND CONSULTANCY SERVICES
PO118: PROMOTING SERVICES THAT FACILITATE NETWORKING AMONG ACTORS INTERESTED IN INNOVATION ISSUES
PO119: PROMOTING PARTNERSHIPS BETWEEN UNIVERSITIES AND ENTERPRISES
PO120: INFORMATION AND AWARENESS BUILDING ON TERRITORIAL INNOVATION

Frame of responsibility 28:  
Juridically and financially enabling environment for innovation

Practical Options
PO121: STRENGTHENING GOVERNMENT COORDINATION STRUCTURES IN THE FIELD OF INNOVATION
PO122: CREATING FURTHER OPPORTUNITIES FOR PUBLIC AND PRIVATE FUNDING OF INNOVATION
PO123: SUPPORTING A STRONGER ENGAGEMENT OF CREDIT FINANCIAL INSTITUTIONS IN THE INNOVATION FIELD
PO124: INTRODUCING FISCAL INCENTIVES FOR COMPANIES PERFORMING R&D
PO125: PROVIDING FINANCIAL SUPPORT TO TECHNOLOGIES THAT CAN PREVENT NEGATIVE SOCIAL AND ENVIRONMENTAL IMPACTS
PO126: ENHANCING THE PROTECTION OF INTELLECTUAL PROPERTY RIGHTS
Frame of responsibility 29:
Innovative spirit in the population

Practical Options
PO127: PROMOTING AWARENESS-RAISING INITIATIVES ON INNOVATION AS A TOOL TO SOLVE SOCIAL AND ECONOMIC PROBLEMS
PO128: TRUST BUILDING ACTIVITIES WITH LOCAL PEOPLE ON INNOVATION ISSUES
PO129: PROMPTING “LAB-WORK” AT SEVERAL LEVELS

Lessons learnt Kenya
• Identifying the economic benefits of new technologies will facilitate their take-up.
• There is scope for building partnerships between the STR community and the informal business sector.

Lessons learnt India
• Establish better linkages between the world of research and the world of production in specific sectors at any level
• Enhancing research and experimentation on sustainable technologies.
• Involve and build the trust of local social actors in the innovation programs
• Foster innovative and good practices of extension services
• Sensitise and support small and medium-sized enterprises in promoting research.

Area 6 - Governance

Frame of responsibility 30:
Quality of policy setting

Practical Options
PO130: PROMOTING PROGRAMS FOR SHARING KNOWLEDGE NEEDED FOR POLICY SETTING
PO131: HARMONIZING THE POLICIES AND REGULATIONS ON STR
PO132: TAKING MEASURES TO LIMIT EXTERNAL INTERFERENCES IN AREAS PERTAINING TO NATIONAL INTERESTS
PO133: ASSURING THAT POLICIES MAKE CONSTANT REFERENCE TO WELL-ESTABLISHED ETHICAL PRINCIPLES FOR RESEARCH
PO134: PROMOTING EXCHANGES AND NETWORKING AMONG DECISION-MAKERS AT THE REGIONAL AND INTERNATIONAL LEVEL ON S&T POLICIES
PO135: ASSIGNING A PROPER ROLE TO SOCIAL SCIENCES IN STR MANAGEMENT AND GOVERNANCE
PO136: CREATING AUTHORITIES ON KEY POLICY ISSUES
PO137: FILLING THE GAPS IN SCIENTIFIC PERSONNEL FOR SPECIFIC KEY ROLES OR SECTORS
Frame of responsibility 31: Dialogue and participation in policy making

Practical Options
PO138: ENCOURAGING BROADER PARTICIPATION IN STR IN SECTORS NOT YET SUFFICIENTLY OPEN TO THE PUBLIC
PO139: PROMOTING AND DISSEMINATING NATIONAL AND LOCAL MAPS OF STR ACTORS
PO140: INVOLVING SCIENTIFIC COMMUNITIES IN SETTING POLICIES AT LOCAL LEVEL
PO141: PROMOTING THE INVOLVEMENT OF PRIVATE ACTORS IN S&T
PO142: INVOLVING NEW GENERATIONS OF YOUNG RESEARCHERS IN S&T DECISION MAKING
PO143: ENHANCING THE ROLE OF YOUNG CIVIL SERVANTS WHO ARE INTERESTED IN S&T ISSUES
PO144: INVOLVING CIVIL SOCIETY ORGANISATIONS IN DECISION MAKING

Frame of responsibility 32: Policies implementation

Practical Options
PO145: ENCOURAGING THE IMPLEMENTATION OF REGIONAL STRATEGIES
PO146: FOSTERING COOPERATION AMONG DIFFERENT PROJECTS IN THE SAME AREA
PO147: CREATING PARTNERSHIPS TO COPE WITH CRISIS OR EMERGENCIES
PO148: IMPLEMENTING PREVENTIVE MANAGEMENT OF THE SOCIAL, ECONOMIC, ENVIRONMENTAL IMPACTS OF TECHNOLOGICAL DECISIONS
PO149: ADOPTING CERTIFICATION SYSTEMS AT THE LOCAL LEVEL
PO150: PROMOTING MONITORING STRUCTURES FOR FOSTERING TRANSPARENCY IN S&T POLICIES IMPLEMENTATION
PO151: INTRODUCING CAPACITY BUILDING PROGRAMS FOR CIVIL SERVANTS IN CHARGE OF COORDINATING S&T POLICIES

Frame of responsibility 33: Participative structures for stakeholders at local level

Practical Options
PO152: EXPERIMENTING WITH NEW FORMS OF CONSULTATION AND CONSENSUS BUILDING AMONG BENEFICIARIES
PO153: CREATION OF LOCAL NETWORKS AND PARTNERSHIPS
PO154: PROMOTING PROJECT COMMITMENT AND PROJECT OWNERSHIP AMONG LOCAL STAKEHOLDERS
PO155: ENCOURAGING THE INVOLVEMENT OF LOCAL POLITICAL, TRADITIONAL AND RELIGIOUS LEADERS
PO156: PROMOTING THE INVOLVEMENT OF LOCAL WOMEN-LEADERS
PO157: SUPPORTING THE EMPOWERMENT OF CIVIL SOCIETY ORGANISATIONS IN THE FIELD OF S&T
PO158: PROMOTING CONFLICT RESOLUTION AT THE LOCAL LEVEL
Frame of responsibility 34: 
Financial resources and infrastructure for research

Practical Options
PO159: Strengthening public structures in charge of S&T funding policies
PO160: Targeting research funds
PO161: Supporting STR actors in fundraising activities
PO162: Acquiring adequate infrastructures
PO163: Updating infrastructure
PO164: Infrastructure maintenance
PO165: Sharing research infrastructures

Lessons learnt Kenya
- There are benefits to be gained from mainstreaming principles of good governance into STR processes
- Transparency at the international level is also essential

Lessons learnt India
- In order to enhance the dialogue and democracy in policy setting there is a need to adopt the principles of plurality, justice, equity.
- There is a need to involve the scientific communities at the university and research institution level in the policy making through dialogue.
- Need to organise capacity building programmes for civil servants in charge of coordinating S&T policies.
- Need to move on in the process to decentralize and provide autonomy to the universities.
- Need to increase funds and infrastructures for research.

Area 7 - Gender

Frame of responsibility 35: 
Equal opportunity and transparency

Practical Options
PO166: Monitoring the number of women scientists and the type of work they do
PO167: Creation and application of gender-sensitive indicators
PO168: Establishing mechanisms to improve gender balance in scientific bodies
PO169: Greater communication of selection and award criteria
PO170: Establishing dedicated offices or appointing staff to monitor the effective application of legislation on women researchers
PO171: Promoting mentoring for women scientists
Frame of responsibility 36:
Reconciliation and support

Practical Options
PO172: INTRODUCING WORK TIMETABLES THAT MEET WOMEN RESEARCHERS’ FAMILY DEMANDS
PO173: INTRODUCING SUPPORT SERVICES PROVIDED BY INSTITUTES
PO174: FACILITATING ACCESS TO EXISTING COMMUNITY SERVICES
PO175: PROMOTING MEASURES TO CREATE ADEQUATE CHILD CARE AND OTHER TERRITORIAL SERVICES
PO176: PROMOTING OPPORTUNITIES FOR INTERACTION AND EXCHANGE AMONG RESEARCHERS IN THE SAME INSTITUTE OR DIFFERENT INSTITUTES

Frame of responsibility 37:
Raising awareness about gender issues in STR

Practical Options
PO177: PROMOTING PUBLIC COMMUNICATION INITIATIVES IN RECOGNITION OF DIGNITY OF WOMEN RESEARCHERS
PO178: PROMOTING INITIATIVES TO RAISE AWARENESS AMONG RELATIVES OF WOMEN RESEARCHERS
PO179: PROMOTING RESPONSIBLE PARENTHOOD INITIATIVES
PO180: PROMOTING AWARENESS-RAISING GENDER INITIATIVES FOR DECISION MAKERS AND PUBLIC OFFICERS
PO181: PROMOTING EDUCATIONAL AND AWARENESS-RAISING INITIATIVES ON GENDER DYNAMICS WITHIN THE SCIENCE COMMUNITY
PO182: PROMOTING INITIATIVES RAISING GENDER AND SCIENCE AWARENESS IN SCHOOLS

Frame of responsibility 38:
Production of knowledge on gender issues in STR

Practical Options
PO183: PROMOTING RESEARCH ON GENDER ISSUES IN STR
PO184: ENHANCING SCIENTIFIC EXCHANGES ABOUT GENDER ISSUES IN STR

Frame of responsibility 39:
Movement on gender issues in science and technology

Practical Options
PO185: SUPPORTING ORGANISATIONS THAT PROMOTE COLLECTIVE ACTION IN FAVOUR OF A BROADER PRESENCE OF WOMEN IN S&T
PO186: SUPPORTING THE PARTICIPATION OF WOMEN RESEARCHERS IN REGIONAL/INTERNATIONAL ASSOCIATIONS AND NETWORKS

Lessons learnt Kenya
- Gender-sensitised scientists can help create a more positive perception of science
- STR programmes can be informed by a gender-sensitive approach
Lessons learnt India

- Need to create options for revival of scientific profession for women.
- Need for better presence of women researchers in scientific bodies (monitoring equal opportunity).
- Increasing the initiatives to raise awareness on importance of supporting the status of women scientists.

**Area 8 - Substantive approaches**

**Frame of responsibility 40:**
Tackling the plurality of knowledge systems

**Practical Options**

PO187: PROMOTING AWARENESS-RAISING AND COMMUNICATION INITIATIVES ON THE VALUE AND POTENTIAL OF INDIGENOUS KNOWLEDGE

PO188: IDENTIFYING EXPERTISE AT THE LOCAL LEVEL

PO189: SUPPORTING THE FINE-TUNING OF LOCAL TECHNOLOGIES TO RESPOND TO LOCAL DEMANDS

PO190: FOSTERING NATIONAL AND INTERNATIONAL PARTNERSHIPS AND COOPERATION BETWEEN INSTITUTES CHAMPIONING INDIGENOUS KNOWLEDGE

PO191: PROMOTING PARTNERSHIPS FOR RESEARCH AND EXPERIMENTATION TO INTEGRATE MAINSTREAM SCIENTIFIC APPROACHES AND PRACTICES WITH TRADITIONAL TECHNOLOGIES

**Frame of responsibility 41:**
Convergence of tradition and modernity

**Practical Options**

PO192: RAISING AWARENESS OF NEW REALITIES IN THE SCIENCE/SOCIETY RELATIONSHIP TAKING INTO ACCOUNT THE NEW GLOBAL DYNAMISMS

PO193: PROMOTING A CRITICAL VIEW OF MODERNITY AND ITS RELATIONS WITH SCIENCE AND TECHNOLOGY

PO194: PROMOTING AWARENESS-RAISING AND COMMUNICATION INITIATIVES ON THE RELATIONSHIP BETWEEN NATIONAL/LOCAL CULTURAL, SCIENTIFIC AND PHILOSOPHICAL TRADITIONS AND OTHER SCIENTIFIC TRADITIONS IN THE CONTEXT OF CURRENT SCIENTIFIC DEBATE

**Frame of responsibility 42:**
Self-reliance

**Practical Options**

PO195: UPDATING RESEARCHERS ON CURRENT RESEARCH AND INNOVATION PROGRAMMES IN THEIR COUNTRY

PO196: DISSEMINATING POSITIVE ACCOUNTS OF SCIENTIFIC AND INNOVATIVE CAPACITY IN THE COUNTRY

PO197: ELABORATING APPROPRIATE INDICATORS OF SUCCESSFUL RESEARCH AND INNOVATION

PO198: PROMOTING A MORE COMPLETE PICTURE OF NATIONAL/LOCAL INTELLECTUAL TRADITION
Frame of responsibility 43: Regulation on indigenous knowledge

Practical Options

PO199: Designing new laws and norms recognizing the value of indigenous knowledge

PO200: Lobbying for the regulation of indigenous intellectual property

PO201: Supporting benchmarking initiatives on the protection and enhancement of indigenous knowledge

PO202: Supporting business initiatives to regulate the exploitation of local forms of knowledge

Lessons learnt Kenya

- Harnessing indigenous knowledge can help make STR more responsive to local conditions and in the design of appropriate initiatives

Lessons learnt India

- Need for an innovative framework that can reposition India’s knowledge capabilities into a plurality of knowledge systems.
- Need to reinvent science, technology and innovation as part of traditions of dialogue on knowledge and democracy.
This STR socialisation area deals with the practice of research groups in the strict sense within public, private and non-profit organisations, as well as the pressures and opportunities faced by these groups. The interactions that affect research groups often feature informal and face-to-face relationships that find their basis in trust, shared ideas and motivations. The creation, survival, and quality of scientific work of these groups are key elements of strengthening scientific research itself.

The deep changes presently affecting both science and society create a serious challenge to research groups, which do not always have opportunities and capacities to cope with them appropriately. This may result in a threat for their survival and their development and may have serious implications for the way in which science and technology impact the social and economic life of a given country.

Actually, all research systems without an exception are deeply influenced in their particular ways by the worldwide transformations of the ways in which scientific knowledge is produced, that was described in the Introduction of these Guidelines (the so-called “Mode 2”). A drive towards a stronger linkage between science and technology and between pure and applied research, transdisciplinarity, economic exploitation of research results, greater accountability and transparency in research, stronger linkages with “external” actors - these are the factors, which, among others, contribute to modifying the social environment of researchers.

These changes have deep effects on the way research is designed and carried out, as well as on the researchers’ profession and social status. In this context, the role played by research groups is very important as far as structuring and supporting the scientific activities of individual researchers are concerned. However, these changes are often risky and traumatic for the functioning of STR and for the relations that science has with its social context. It is therefore a specific duty of those who are responsible for STR to make these risks known and controlled.

On the following pages on the basis of the outcomes of research and discussions under SET-DEV, four significant sets of risks pertaining to scientific practice are singled out as well as actions required to tackle them. These sets of risks correspond, as proposed in the Introduction, to specific frames of responsibility. For each of them, some practical options are identified.

The four frames of responsibility are of particular importance:

- the contextualisation of research;
- the quality of research;
- researcher’s identity;
- the generational change.
From The Knowledge Swaraj\textsuperscript{9}: An Indian Manifesto on Science and Technology

(…) “This Manifesto starts by arguing for a plurality of knowledge and expertise. Then the need is argued for a new social contract on science in India—science and technology do not develop in a social vacuum. Conclusions are drawn to indicate how a swaraj of science and technology will yield justice, sustainability and plurality.” (…) 

(…) “A new science and technology policy needs to be as down-to-earth and rooted in the Indian experience as this Manifesto is. That implies the need for a transparent discussion of the economies of science and technology. Globalisation exists, but it is also continuously re-made by the accumulated efforts of a multitude of actors, individual and institutional. Economic and financial relations are important, and sometimes even violent, but not unchangeable. A new Indian policy for science and technology will aspire to quality rather than to quantity, and will invest in infrastructure and process rather than events and products.” (…). 

From The African Manifesto for Science, Technology and Innovation

(…) “Africans must de-mystify science and technology from its current perception as an “ivory tower” activity to a space for gaining knowledge and codifying experiences through systematic observation, experimentation and measurement of phenomena and the formulation of laws to describe the observed facts in general terms. The traditional means of gaining knowledge through multiple perspectives, lateral thinking and shared opinions within communities need to be mainstreamed into the new African scientific paradigm.

Expressed in the currency of modern scientific language, this is a call for problem solving through multi-disciplinarity, transdisciplinarity and systems thinking. Only with such an improved public understanding of and space for participation in science, technology and innovation, can we hope that the African public will engage in the democratic governance of STI.”(…) 

\textsuperscript{9} The word “Swaraj” refers to the concept of self-rule as developed by Gandhi.
A key aspect of the socialisation of STR is the contextualisation of research, namely the act of "embedding" it in a given social and cultural context to make it more relevant to the needs of specific communities or groups of people, whilst maintaining, of course, rigorous scientific standards.

There are many factors in transition and developing countries that make such contextualisation particularly difficult, including the continued (albeit waning) use of the "ivory tower" model of scientific research; the adoption of imitative research design uncritically based on Western research procedures and agendas; difficulty of establishing an open relationship between academics and local communities and the mutual mistrust that researchers and civil society often feel for each other, bearing the risk of a dangerous split between STR and the needs of society. In this regard the Knowledge Swaraj: An Indian Manifesto on Science and Technology, developed under SET-DEV, emphasises that it is essential to recognise the plurality of expertise and knowledge systems. This can form the basis not only of more democratically established research priorities and agendas, but also of an opening up of the research world to the needs of society. This can lead to effective dialogue, "learning from people", between researchers and stakeholders at local level.

STR contextualisation is therefore an important frame of responsibility, concerning which, on the basis of SET-DEV experience, the following 6 practical options can be taken into consideration.

**PO1: Sensitising researchers towards dialogue with stakeholders**

To help researchers conceive their research in terms of local needs, it is important to promote awareness raising and dialogue with national and local stakeholders. This could involve training and refresher courses, examination of successful experiences of stakeholder dialogue, field visits to major projects, and more. Awareness raising may also be carried out during "work in progress", exchange initiatives and services involving the research community and stakeholders (see box below).
MEETINGS BETWEEN RESEARCHERS AND STAKEHOLDERS IN INDIA AND AFRICA:
SET-DEV CAPACITY BUILDING WORKSHOPS AND FOCUS GROUPS

Practices

The problems of the responsibility of society towards science and technology research, ethical dilemmas in science were some of the topics at the centre of a series of capacity building workshops and focus groups held in India and Kenya as part of SET-DEV in 2009 and 2010. These initiatives were also designed to encourage dialogue between researchers and stakeholders, particularly civil society organisations, businessmen and media representatives. In India the workshops in Hyderabad in September 2009 and January 2010 addressed various aspects of the relationship between ethics and socialisation of STR; the focus group of Bengaluru in February 2010 discussed climatic changes and the Focus Group Discussion in Hyderabad dealt with ethical dimension of communication in March 2010. In Kenya the Mombasa capacity building workshops in July 2009 focused on different aspects of socialisation of STR and the Mombasa Focus group debated scientific communication in Kenya in March 2010.

For more information: www.set-dev.eu

THE RESEARCH COMMUNITY OPENING UP TO STAKEHOLDERS: THE EXPERIENCE OF SCIENCE SHOPS

Practices

A type of experience in Europe which was instrumental in consolidating interaction between social actors and research institutions and groups was the science shop. These were set up at universities and research laboratories, to provide low-cost or free of charge services (research, consulting, and assistance) to benefit the local population, with the aim of placing the products of scientific and technological research at the service of the community. This model took shape in the late 70s in the Netherlands, and has spread to other European and non-European countries. Some examples of the activities carried out by science shops include: a study of the exposure of the inhabitants of a building in Groningen to electromagnetic waves; a study on the effects of the use of wormers on animals in a nature reserve in Utrecht; a study of the social practices of young people in Salzburg, to develop specific support policies.

d’Andrea, Quaranta, Quinti 2005; Bijker, d’Andrea 2009

PO2: Promoting meetings and exchanges with civil society organisations

To overcome the climate of mutual mistrust that sometimes exists between researchers and civil society organisations, meetings and exchanges of views should be promoted, such as workshops and working groups on specific issues. Some such initiatives were studied and partially tested under SET-DEV both in India and Kenya. These initiatives, which are outlined in the box below, will be repeatedly mentioned and illustrated in these guidelines.
MEETINGS BETWEEN RESEARCHERS AND CIVIL SOCIETY ORGANISATIONS AT LOCAL LEVEL

Practices

Under SET-DEV, a number of initiatives were examined involving interactive meeting between researchers and civil society organisations, for example: collaboration between researchers and NGOs to disseminate Methods of Non-Pesticidal Pest Management (NPM) in India; the joint submission of projects for sustainable post-tsunami reconstruction in Tamil Nadu (India), involving experts and local NGOs; cooperation between research institutions and local NGOs in the fight against food plant pests in Kenya; cooperation between a Kenyan university and grassroots organisations in local sanitation projects in urban areas.

SCIENTISTS AND CIVIL SOCIETY ORGANISATIONS IN INDIA

SET-DEV project was able to bring the scientists and the stakeholders to interact with each other through the consultative workshops. In India, the science stream researchers are relatively insulated from stakeholders and beneficiaries. They are working in their laboratories and the sensitizing activity depends on the researchers’ awareness and attitude.

The structure of the scientific organisations does not seem to promote meetings or exchanges with civil society organisations. It could be observed that during the SET-DEV project, the workshops conducted at the UoH facilitated an active sharing of insights among participants from civil society organisations, especially KICS and CWS, and scientists and academicians from UoH and other institutions. The discussions and deliberations at the workshops have been effective in integrating the values within the society reflected by the CSOs and values within the scientific community. This is especially relevant in the context of regulation within scientific research. The differences between scientific values and societal values within academia and society were visible in the course of discussions.

Excerpts from University of Hyderabad SET-DEV working papers

PO3: Joint defining of research objectives with stakeholders

Scientific research agendas are often defined in places remote from target areas and stakeholders (local politicians, businesses, civil society organisations, etc.). One way to overcome this, therefore, is to jointly define research objectives (or at least parts of them) with these stakeholders. At Egerton University (Kenya), this involves co-planning, and establishing specific memoranda of understanding for projects in fields like engineering and agriculture (see box).

EGERTON UNIVERSITY (KENYA): DIALOGUE WITH STAKEHOLDERS AND RELEVANCE OF THE RESEARCH

Practices

“The institution is committed to building an African University that interfaces with other knowledge communities to solve local problems through a deep connection with the local context. All of the programmes have to be approved by stakeholders taking into account the local needs and the priorities of the African context. Even research programmes have to be approved by stakeholders, to be sure that they are socially relevant. Collaboration is encouraged through memoranda of understanding especially with different public organisations”.

Excerpt from the documents of case study on Egerton University - SET-DEV
**PO4: Disseminating participatory methodologies**

Although good will may not be lacking, sometimes there are no tools or means for researchers to interact with stakeholders in the context of specific research projects. For this reason it is important to promote participatory practices increasingly experimented with all over the world (see box).

**PARTICIPATORY METHODS IN SCIENCE AND TECHNOLOGY**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is an extensive literature on participatory tools applied in managing technology development projects. As far as the European experience is concerned these tools include advisory committees of citizens at central and local levels (to address specific ethical, economic and social issues); consensus conferences (public surveys to resolve controversial issues); focus groups (meetings in which various interested groups compare their views and proposals); referendums (to resolve general issues and which may be of a binding nature from a legal or political standpoint); participatory planning (e.g. for the management of urban areas), service conferences (i.e. discussions between service providers and stakeholders).</td>
</tr>
</tbody>
</table>

For further details: d’Andrea, Quaranta, Quinti 2005

**PO5: Sensitizing researchers towards dialogue with disadvantaged social groups**

Researchers should devote specific attention to the most disadvantaged and marginalized social groups, which in many cases represent the majority of the population. To this end, information and awareness raising initiatives should be supported both at the level of researcher networks and associations and at the level of individual research institutes. Such initiatives may include experimenting with various forms of dialogue and joint development of technological solutions with representatives of disadvantaged categories of population (see box).

**SANITATION: PRO-POOR TECHNOLOGIES IN KENYA**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most of research activities undertaken at Egerton University are applied research with an emphasis on innovation, technologies and products that are pro-poor and reach out to a wider community. For instance, during the violence that resulted from the contested country elections of 2007, a lot of people were displaced and concentrated in camps and did not have proper sanitation facilities and therefore were exposed to contracting cholera among other diseases. The Resource Oriented Sanitation for the Peri-Urban areas in Africa (ROSA) project stepped in to develop and supply portable toilets in conjunction with the municipal council to help manage the situation.</td>
</tr>
</tbody>
</table>

From the working documents of the Kenya Pilot Programme (SET-DEV), 2009

**PO6: Mapping and enhancing local expertise**

It is important for policy makers, scientists, and sociologists to map local expertise (e.g. in agriculture, health, arts and crafts, etc) that may be enhanced through research and technological development. In particular, existing local knowledge and technologies should be identified together with the people who use them. Such activities have been carried out, for example, in one of the case studies examined by SET-DEV in Kenya, organised by ICIPE. In
general, on the basis of European, African and Indian experience, this field of activities can include: collection of historical documents and statistics, individual and group interviews, direct observations of projects, laboratories, workshops, etc.
One of the main outstanding issues in the area of scientific practice, as evidenced by research activities carried out under SET-DEV, is the quality of research. It is not easy today to ensure an adequate level of research quality because of the difficulties involved in managing the changes underway in the production of scientific research, and because of the persistence of old problems in the management of institutions.

For example, one serious problem that emerged in all contexts is the excessive amount of administrative and management work that often falls on research groups and individual researchers (e.g. fund raising), draining valuable energy from scientific activity.

Other common obstacles are the pervasiveness of the patronage system and the consequent difficulties in promoting meritocracy, lack of connection between the quality of scientific work and career progression, the shortage of organisations and tools to verify the quality of scientific work, the spread of misconduct in research (e.g. unauthorised and undeclared borrowings from colleagues and collaborators). As one can see, some of the problems related to the quality of research have a strong connection with the ethical dimension. But research ethics is a topic that is still not common in university curricula. It follows that ethics is seen as an element that lies outside and is residual to research activities.

To resolve these issues, there is certainly much to do, and this means that the quality of research is a specific frame of responsibility. In this regard, on the basis of SET-DEV findings, some practical options can be mentioned.

**PO7: Reducing bureaucratic and administrative burdens on researchers**

It is important to restore the primacy of research, reducing the amount of paperwork that researchers need to do. This concern is increasingly present in the thinking and practices proposed by experts in the field of research management, a field of study that is spreading rapidly in India and Africa. For example, initiatives can be promoted, dedicated staff can play a greater role in carrying out managerial and planning activities to obtain funding, deal with paperwork, etc. (see also Area 2).
PO8: Producing guidelines on research quality

A tool to promote research quality could be the introduction of guidelines for heads of scientific and technological research institutions and individual researchers. These guidelines may concern both the responsibilities of researchers as regards the quality of research in general (see box), and quality in specific areas or sectors (e.g. health, experimentation procedures, etc).

RESEARCH QUALITY AND ETHICS IN INDIA

Practices

Scientific and technological research in India has sometimes faced issues of inappropriate behaviour and practices by researchers. To address this, in 2005 the Academy Committee on Scientific Values of the Indian Academy of Sciences prepared the document "Scientific Values: Ethical Guidelines and Procedures". This document formulates indications about the accountability of researchers in their daily work, affecting the various aspects of research quality. The following areas are identified: (i) research conduct; (ii) publications; (iii) student training; (iv) interaction with the public; (v) science management; and (vi) ethics in technology-related issues. In this regard, specific procedures were also identified for reporting problems and abuses.

These guidelines may provide a useful reference tool for individual research institutions, and are available on the IAS site: www.ias.ac.in. To facilitate application, an "Academy Panel on Scientific Values" was set up, to examine reports and complaints received by the Academy.

***

The Science and Engineering Research Council (SERC), established in 1974, offers several guidelines for implementing research proposals http://serc-dst.org/newguideline.htm and managing research projects for research fellows, scientists and project assistants. SERC is an apex body through which the Department of Science and Technology (DST), Govt. of India, promotes R&D programmes in newly emerging and challenging areas of science and engineering. SERC is composed of eminent scientists, technologists drawn from various universities/national laboratories and Industry. This Council is assisted by Programme Advisory Committees (PACs) in various disciplines of Science & Engineering.

***

At the level of individual institutions, such as the University of Hyderabad, in the science stream, there are boards such as the Institutional Ethics Committee, the Committee for Biosafety, or the Research Review Board. Such boards, however, do not exist for the social science research stream.

At the University of Hyderabad, Animal Ethics Committee is chaired by a School member for the concerned department; the Institutional Ethics Committee chaired by a Judge (usually from High Court) where human subjects and others are engaged for genetic material such as blood samples for research.

www.ias.ac.in/academy/sci_val/scival-report.pdf and Excerpts from University of Hyderabad SET-DEV working papers
**PO9: Producing indicators of scientific misconduct**

One way to minimise misconduct in research and promote quality in scientific work is to develop and disseminate specific indicators of scientific misconduct. These indicators can be used as a reference tool for directors of institutes and research centres or research groups as a basis for possible guidelines (see above), or as a working tool for supervisory committees (see below).

**Aspects of Scientific Misconduct**

Sujit Bhattacharya, NISTADS, New Delhi

(...) “There is a belief in the scientific ethos of truth seeking which is high in science. However there are incidents of unethical practices originating from headline grabbing attitude, plagiarism and these are all pervasive. Scientific misconduct is mainly in the fudging and false presentation or fabrication of data and peer review addresses the two issues. There is a need for the editors and referees to look for indicators for scientific misconduct. Misconduct, though observed among a small proportion of authors, was classified by a National Institute of Health study. Aspects of misconduct include cooking data, ignoring the rules regarding use of human subjects in experiments, non-disclosure, flawed data, non-presentation of contrasting data, changing design and methods and results due to pressures form funding source, publishing same data more than once, credits mis-appropriation, carelessness and inappropriate research design. On the editorial side in assessing the manuscripts, the study by Bornman et. al., indicates the ethical issues in manuscript selection, relevance of contribution, writing and presentation, design, methods and relevance consideration, discussion of results, references and literature documentation. The reasons for misconduct are that the authors are tempted to exaggerate their results due to a large number of submissions from which they wish to gain importance, a pressure to publish, to override a critical assessment. There is a need to make institutional changes within science and mechanisms to strengthen the conduct of scientists. The consequences of the failure of mechanisms are growing scepticism, disenchantment, public critique, externalising peer review.(...)”

Excerpt from a speech at: the 2nd Capacity building initiative on science, ethics and socialisation of STR, 18th and 19th January 2010, School of Social Sciences, University of Hyderabad, within the framework of SET-DEV project

**PO10: Creating self-regulatory systems**

To effectively promote research quality a statement of general principles is not enough; self-regulatory systems are needed. To this end, structures and bodies need to be created or strengthened, especially at a national level, which can, for example, establish rules on research quality and ethics, monitor the implementation of these rules, identify and apply punishments or, conversely, incentives and rewards to make the rules effective. This can be carried out by appropriate governance and assessment bodies, such as the Department of Science & Technology, Ministry of Science & Technology or the Council for Scientific and Industrial Research in India, or the Ministry of Higher Education, Science and Technology and the National Council for Science and Technology in Kenya (see PO8 and areas 4 and 6). It is also important to create local structures (for example, specific committees, observers or offices), even within individual institutions and research centres.
PO11: Introducing the ethics of research into academic didactic programmes

As it is clear from experience in Europe, as well in India and Kenya (and Africa in general), there are many ways to promote scientific research ethics within academic teaching, including regular seminars to promote awareness and to update researchers on research quality, which can be linked to the issue of research ethics; appointing designate people in institutions or universities to organise events and activities on research quality, including issues concerning ethics and professional conduct (through publications, files, meetings, etc); creating specific curricula on research ethics not only in faculties and departments concerned with social sciences and humanities, but also with pure sciences.
FRAME OF RESPONSIBILITY 3

RESEARCHER’S IDENTITY

- **Rationale**

For some time now it has been clear that a switch to a new mode of scientific production, called by some “post-academic science”, often occurs too quickly and is traumatic for researchers, thus posing serious problems in terms of social and professional identity. Changes linked, for example, to the relationship between research and innovation, the emergence of social actors involved with research other than scientists together with a more competitive environment for accessing funds, multidisciplinarianism and multisectoralism, a greater contextualisation of research to the demands of beneficiaries, etc, often greatly disorient researchers. At the same time, these processes reinforce a tendency to lower the social and economic status of researchers, which stems from the various economic crises that have occurred in recent decades (especially in developing countries), resulting in, for example, the brain drain and widespread popular disaffection towards science and technology (see Area 3). Also to be noted is the low social status of social science researchers compared to those in the so-called “natural” sciences (physics, chemistry, biology, etc). Of course, these global changes are manifested differently depending on national and regional situations.

In addition to these contextual issues, there are others that directly affect the functioning of research. The first concerns the difficulty in promoting and especially maintaining research as a typically but group activity. The second problem is the difficulty of accessing - either directly or indirectly, via the Internet - adequate research facilities (for more specifically infrastructural aspects see the section on governance). The third issue is securing acceptance to global science networks which are critical for acquiring and exchanging information and knowledge that are difficult to obtain or at national or local level. SET-DEV research has revealed many related outstanding issues, particularly of a cultural and organisational nature, for example: the strong tendency of research centres and institutes to work separately; difficulties in establishing cross-sectoral links (different fields of research are sometime seen as having different importance by science executives and policy makers); lack of knowledge exchange among researchers specializing in the same field; excessive specialisation in the way research is set up and conducted (this produces compartmentalisation in the research system, preventing collaboration and information exchanges); difficulties working in multidisciplinary teams, and more.

Overall, there emerges a need to support the development of a new identity for researchers, reflecting changes in the context of scientific production. This is an important frame of responsibility, which importance and complexity was highlighted by SET-DEV. In this respect a number practical options are available.
PO12: Promoting an awareness among researchers about new mode of scientific production, and related risks and opportunities

To manage the disorientation of the researchers caused by the gradual transition to new modes of science production, researchers could be made more aware, at the local level and in individual institutions, of the changes, risks and opportunities related to these changes. For this purpose briefings and updates on the new mode of science production could be organised, including themed seminars on issues affecting Europe, India and Africa, such as: the increasingly close relationship between research and innovation; greater contextualisation of research, the role of stakeholders in STR dynamics, the new constraints, uncertainties and opportunities for research funding; the increased role of the multidisciplinary approach, etc.

PO13: Fostering the social and economic status of researchers

It is important to promote a greater awareness among decision managers, all social and economic actors and the general public of the socio-economic status of researchers as a crucial resource for the development of society. In this regard, different types of programmes and initiatives can be implemented, such as seminars to sensitise decision-makers, public communication campaigns promoting the social image of researchers, the establishment of researcher associations and lobbies to promote favourable policies, and more. Equally important are initiatives to create a favourable environment for researchers and scientific research in general, such as the Training and Sensitisation Program developed by ATPS, a SET-DEV partner. This programme includes, inter alia, awareness raising and training activities for parliamentarians and top decision makers on science issues.

PO14: Providing incentives for research activity

To boost researcher identity, it is important to implement initiatives that improve the quality of their lives. In particular, it is important to provide adequate incentives for researchers. In this regard, initiatives at the municipal level that encourage expatriate researchers to return home or prevent promising academic from emigration are particularly important. They may include incentives in terms of housing, transport, health care, children’s schooling, consumption opportunities, reimbursements for research travels, etc. Such measures have been adopted by the State of Andhra Pradesh recently and proved their efficiency. More targeted instruments, such as performance-linked contracts, are also appropriate especially as a way of retaining and motivating young researchers.

PO15: Promoting scientific exchanges among entities within the university and with other universities/centres at the national level

To overcome mistrust and isolation among researchers, it is important to promote a serious of activities in support of scientific exchanges among departments within universities and between universities and research centres at the national level. This can be usually achieved by creating dedicated offices or appointing relevant professional staff that will provide a range of services such as information exchanges, lectures and partnerships to implement joint projects.
PO16: Promoting access to transnational structures to optimise research

To overcome limitations related to poor or inadequate on-site research capacity and optimise the efforts of a number of centres and research laboratories around the world, more and more transnational cooperation networks are being created. These networks usually have a technological base linked to the Internet. An important example is the project "Open Source Drug Discovery (OSDD) launched recently in India (see box).

OPEN SOURCE DRUG DISCOVERY

Practices

It is estimated that in India every year about 370,000 people die of tuberculosis. However, the world’s major pharmaceutical companies have not shown any interest in investing in research of this and other diseases mainly affecting the poor in tropical countries. To address this problem, the Council of Scientific and Industrial Research (CSIR) of India promoted in 2008 the "Open Source Drug Discovery " (OSDD). The programme is set up as a partnership between government research bodies and private organisations aimed at finding affordable health care solutions for developing countries, identifying appropriate therapies to tackle important but neglected diseases (such as malaria, tuberculosis, leishmaniasis, etc.). This is done through a global framework where the best minds work together to solve the problems of research in this field. This is done using "Open source" computer models (similar to Wikipedia), which provide every opportunity for interaction and cooperation. The programme is open to the participation, even temporary, of students and researchers.

www.osdd.net

PO17: Promoting the participation of institutes and researchers in transnational networks for scientific exchange

The participation of scientific institutions and individual researchers in transnational research exchange associations and networks should be especially encouraged. It seems important, therefore, to deliberately promote such participation where it is lacking or to reinforce it where it is already practiced through adequate structures and activities: researcher associations, attendance of conferences, participation in discussion groups, exchange visits, etc. Some experiences examined during SET-DEV highlighted such practices, for example ICIPE in Kenya and KICS in India (for details, see: http://www.icipe.org/; http://www.kicsforum.net/).
The strengthening of scientific research, as described above, also involves the survival and consolidation of research groups over time. There are many difficulties in this field that prevent adequate generational change as has been highlighted by research carried out under SET-DEV. These obstacles include, for example: the persistence of a gerontocratic and anti-meritocratic culture; inadequate recruitment procedures; a university environment that discourages young people from getting involved in research (e.g. focusing only on teaching activities and thus discouraging research); lack of mentoring; tendency to underutilise researchers; reduced chances of generational change due to brain drain (particularly from public to private research or to other countries); precarious employment status. Despite interventions designed to attract young talent in the world of research, much evidently remains to be done.

Generational change, with a view to gender balance, therefore, is a key element of attracting and keeping young talent in research and ensuring the continuity of research working groups over time. This is a specific frame of responsibility, concerning which the following practical options have been identified.

**Rationale**

Attracting and keeping young talent in science and ensuring the continuity of research working groups over time.

**Practical Options**

**PO18: Providing structures or functional roles within research institutes focused on recruiting young researchers**

It is important to set up structures or appoint staff in research institutions to deal specifically with the recruitment of young researchers. The experience of many institutions (European, but not only) shows the importance of the following aspects: the provision of structural resources (rooms and furnishings, computers with Internet connection, etc); trained staff (responsible for coordination and scouting, officials, administrative staff and archivists, etc); identification and adoption of rapid and transparent selection and recruitment procedures.

**PO19: Assuring support services for young researchers**

It is particularly important to create dedicated support services to support young researchers who just start their career at a new place of work. These services typically include information on the purposes and operation of the organisation, guidance (e.g. assigning
young people tasks according to their real capacities) and mentorship as a form of continuous support provided by older and more experienced people.

**PO20: Monitoring careers**

It is important to monitor the careers of young researchers to limit the negative effects of informal and non-transparent power dynamics. Specific items to be monitored could include, for example, tasks assigned to young researchers, or assessment activities functional to promotion and awards. Based on experience gained in various national and local contexts, monitoring activities can be carried out by ad hoc structures or existing departments (such as those dedicated to recruitment or mentoring, staff offices, etc), properly sensitised and provided with adequate skills and with the participation of representatives of young researchers, with a view to gender balance. It is also important that the criteria used in the monitoring activity be gender sensitive.

**PO21: Promoting forms of support and scientific qualification**

Support to combat the widespread underutilisation of young researchers can be provided through internships, education trips, involvement in scientific exchange networks, etc. An example of this support is the African Youth Forum on Science and Technology (AYFST), promoted by the ATPS (see box).

---

**AFRICAN YOUTH FORUM ON SCIENCE AND TECHNOLOGY (AYFST)**

Practices

ATPS promoted the African Youth Forum on Science and Technology (AYFST). The Forum presents the youth with the platform to engage and utilise opportunities in agriculture science and technology to develop creative responses to the challenges of poverty and underdevelopment in cooperation with relevant institutions of society. This is done by: building the capacity of youth in agriculture, science and technology; sharing of information and networking amongst the youth; promoting youth-led research and innovation projects; enhancing youth participation in S&T policy and decision-making; facilitating career mentorship by senior researchers.

Each annual meeting involved around 80 youth leaders and professionals from several African countries. Starting from the experience of AYFST, ATPS recently launched the Youth Innovation Challenge Program (Y I CAN), which, among other things, envisages incubation activities, awarding, internships and fellowships, training initiatives and peer-to-peer cooperation schemes addressed to young scientists.

http://www.atpsnet.org

**PO22: Supporting scientific publications by young researchers**

A service of particular value to young researchers in research institutions is access to scientific publications. This service, as revealed by SET-DEV research in India and Kenya (see also Area 2) is usually provided by library and documentation services, and in-house knowledge management, or even the heads of departments or other centres and working groups. This service must include information on opportunities to publish in established journals, both domestic and international, and support for young researchers in the production of papers and books to be published.
LESSONS LEARNT ON SCIENTIFIC PRACTICE

LESSONS LEARNT ON SCIENTIFIC PRACTICE: KENYA

- A multi-disciplinary and participatory approach to scientific practice is fundamental to the STR socialisation process
  
The use of participatory approaches has long been accepted as indispensable to the development process. There has been a growing recognition, too, that multi-disciplinary perspectives on development are also needed. With the potential for science, technology and innovation to play a greater role in addressing development issues such as poverty reduction, sustainability, and so forth, it is essential that a multi-disciplinary and participatory approach is built into scientific practice.

- The current focus of STR should be enhanced and broadened
  
  STR in Kenya focuses primarily on the agriculture and health sectors. With other challenging development issues, such as poverty reduction, climate change, renewable energy sources, sustainable environmental development, access to adequate water and sanitation, low-costing housing, and so forth, coming increasingly to the fore, there is much potential and need - for STR’s current focus to be enhanced and broadened to cover other sectors.

- Greater coherence, coordination, and cooperation amongst the numerous organisations involved in STR/STI is needed
  
  There is a myriad of agencies and organisations, whether local, national or international, which are involved in some way or other with STR/STI in Kenya, and hence have a role to play in the socialisation process: their contribution to this would be increased if greater coherence, coordination, and cooperation amongst them were to be achieved.

- There is a need for greater equality between local researchers and their international counterparts
  
  In seeking greater equality, the status of local researchers, and the quality of their research work, can be enhanced by phasing out the differentials between them and international researchers, and by institutionalising strong quality assurance principles in local research institutes/centres.
In the contextualisation of the scientific research, there is a need for an increased interaction between the researchers, stakeholders and the CSOs through meetings, forums, and platform for communication.

For research funding, there is a need for decentralisation. Autonomy to the researchers and less bureaucratic procedures in utilisation of funds and project administration is needed. It has to be stressed that the researchers should be accountable to deliver the promised research outputs.

Improving the quality of the research (by evolving guidelines, regulatory systems, reducing bureaucratic burdens on researchers, etc.). There are several regulatory bodies and regulations in India. However, there is a need for continuous learning by making them more broad-based and democratic.

In improving the social and economic status of researchers there is a need for an attractive pay package and a periodic pay revision, perks, subsidised housing, health care, children’s schooling, provision of accommodation for living space at nominal charges, reimbursements for research related travels and several such grants are ways by which the researchers’ social and economic status is fostered along with several scholarships and funding.

For further information, see also:

Area 2: frame of responsibility 5
Area 3: frames of responsibility 10, 11, 13
Area 4: frame of responsibility 20
Area 5: frames of responsibility 23, 24
Area 6: frame of responsibility 34
Area 7: frame of responsibility 35
Area 8: frame of responsibility 40
SUMMARY

Area 1 - Scientific Practice

Frame of responsibility 1:
Contextualisation of research

Practical Options
PO1: Sensitising researchers towards dialogue with stakeholders
PO2: Promoting meetings and exchanges with civil society organisations
PO3: Joint defining of research objectives with stakeholders
PO4: Disseminating participatory methodologies
PO5: Sensitizing researchers towards dialogue with disadvantaged social groups
PO6: Mapping and enhancing local expertise

Frame of responsibility 2:
Quality of Research

Practical Options
PO7: Reducing bureaucratic and administrative burdens for researchers
PO8: Producing guidelines on research quality
PO9: Producing indicators of scientific misconduct
PO10: Creating self-regulatory systems
PO11: Introducing the ethics of research into academic didactic programmes

Frame of responsibility 3:
Researcher’s Identity

Practical Options
PO12: Promoting awareness among researchers about new mode of scientific production and related risks and opportunities
PO13: Fostering the social and economic status of researchers
PO14: Providing incentives for research activity
PO15: Promoting scientific exchanges among entities within the university and with other universities/centres at the national level
PO16: Promoting access to transnational structures to optimise research
PO17: Promoting the participation of institutes and researchers in transnational networks for scientific exchange
Frame of responsibility 4:
Generational change

Practical Options

PO18: PROVIDING STRUCTURES OR FUNCTIONAL ROLES WITHIN RESEARCH INSTITUTES FOCUSED ON RECRUITING YOUNG RESEARCHERS

PO19: ASSURING SUPPORT SERVICES FOR YOUNG RESEARCHERS

PO20: MONITORING CAREERS

PO21: PROMOTING FORMS OF SUPPORT AND SCIENTIFIC QUALIFICATION

PO22: SUPPORTING SCIENTIFIC PUBLICATIONS BY YOUNG RESEARCHERS

Lessons learnt Kenya

- A multi-disciplinary and participatory approach to scientific practice is fundamental to the STR socialisation process
- The current focus of STR should be enhanced and broadened
- Greater coherence, coordination, and cooperation amongst the numerous organisations involved in STR/STI is needed
- There is a need for greater equality between local researchers and their international counterparts

Lessons learnt India

- The need for an increased interaction between the researchers, stakeholders and the CSOs.
- For research funding, there is a need for decentralisation.
- There is a need to foster the quality of the research, by evolving guidelines, regulatory systems, reducing bureaucratic burdens on researchers and other tools.
- Improving the social and economic status of researchers is necessary.
Chapter Two

Area 2

Scientific mediation

One important STR socialisation area, which nonetheless has received little attention so far, is what we describe in this Guidelines as “scientific mediation”. It deals with a set of management and support skills in research institutes that aim at improving the work environment in which researchers operate, promote scientific activity, facilitate relations between institutions and external players, and ensure the survival and development of the institutions themselves.

Five domains can be identified as pertaining to the “mediation” area: research management (includes administration and planning, power relationships within research institutions and with external actors); teaching (includes management of new functions related to teaching and to linkages between teaching and the social and economic context); networking (the fostering of relationships between scientists and other local actors); project design and promotion (includes the design and promotion of new research projects and programmes, also for accessing research funds); knowledge management (includes exchange, diffusion, manipulation and transfer of scientific knowledge).

If research organisations do not pay sufficient attention to scientific mediation, they start to progressively lose control both in their inner relations and in their relations with external actors. Investigation under SET-DEV has demonstrated that this is a recurrent problem which manifests itself through specific sets of open issues that, in this Guidelines, will be understood as different frames of responsibility. These frames, presented in detail in the following pages, relate to:

- general management and administration of research;
- knowledge management and circulation;
- new teaching functions;
- territorial and international relations;
- research design for funding.
The life and success of a research institute are greatly conditioned by appropriate management and organisational support.

The management of research is clearly an area in which research institutions face the risk of being unprepared to alterations to research context and the challenges that society poses to science and technology.

The following issues emerged during SET-DEV activities: general underestimation of the role of management in supporting science, so that this function is scarcely considered as relevant within research organisations; lack of professional profiles for research managers (e.g. it was often found that those responsible for the administration of universities are chosen only on the basis of scientific merit or seniority, or, conversely, that they are technical personnel that have no knowledge of the problems of research); lack of awareness training for administrative staff helping them to better understand the peculiarities of scientific research; lack of facilities and services for supporting researchers to better exploit intellectual property rights; excessive bureaucracy in scientific institutions (producing delays and malfunctions in recruitment, evaluation, promotions, appointments, etc); lack of autonomy (or lack of effective financial and academic autonomy in structures such as departments, despite policies and guidelines addressing this problem); the adoption of managerial and organisational models borrowed from other sectors (e.g. industry) without proper adaptation.

On the other hand, some significant experiences identified and discussed during SET-DEV showed how the life and success of a research institute, or its specific scientific projects, are greatly conditioned by appropriate management and organisational support. An important frame of responsibility in the area of scientific mediation is, therefore, the organisational management of research, concerning which the following practical options have been identified.

### Practical Options

**PO23: Institutionalise the role of science manager in research institutes**

It is important for institutions to establish the role of science manager and identify the specific functions and types of activities for this post. The role of science manager should preferably be assigned to people who can combine a managerial expertise with knowledge of scientific research issues. A role in promoting this position can be played by transnational networks and associations (see the EDULINK project in the box below), government institutions responsible for scientific research, and individual institutions and research centres.
THE EDULINK PROJECT IN AFRICA

Practices

Many African universities lack management capacity, which affects organisation and operation. In 2001, the directors of agricultural departments of 21 African universities identified a set of training needs, which were later validated by the RUFORUM, a regional network that brings together representatives from 17 universities, FARA and a number of European universities. On this basis the EDULINK project was launched, with the aim of increasing the capacity of universities in East and Southern Africa (including 4 in Kenya) to engage in innovation processes concerning the development of leadership, management and cross-cutting competencies. To achieve this objective capacity building activities were initiated for managers of universities, especially in the areas of facilitation; management; teambuilding; communication; management in a changing environment.

The growth of management skills and capacity in African universities facilitates a better access to resources and better management of research processes and the relationship between research and teaching.

Moreover, the regional dimension of the project contributes to the establishment of networks and forms of interuniversity cooperation that facilitate the definition and implementation of a research and teaching agenda more closely linked to local needs.

www.ruforum.org

PO24: Introducing awareness-raising courses and seminars for officials and researchers on management and organisational culture

It is important to have awareness-raising courses and seminars for officials and researchers, to create a cultural environment conducive to the introduction of new and more appropriate management and organisational models. Some of the issues to be addressed are changes in the way scientific knowledge is produced; the importance of research management; organisational models for research; staff management in research institutes; research funding; relation with territorial actors; scientific relations at national and international levels, and more.

PO25: Training or refresher courses for administrative and technical staff

Given the growing challenges faced by administrative structures in the current research environment, it is vital to guarantee ongoing training or refresher courses for the managers and staff of these structures. World Agroforestry Centre (an international organisation based in Kenya) has set up specific organisational and financial management services to support the work of its researchers through training and refresher courses, human resource management, infrastructure management and the circulation of information. As shown by NAARM in India (see box) there are numerous themes that may form the basis of training activities, such as the centrality of management, contract management, the use of information technology and the Internet, and more.
Practices

Within research institutions, the following aspects have become increasingly important: having expertise in the field of management; having an efficient system of personnel management; adopting new technologies to simplify the work of researchers. In India, as part of a broad programme of training initiatives, the National Academy of Agricultural Research Management (NAARM) offers training courses to increase the capacity of administrative and technical staff to support research work.

The programmes cover topics such as management and leadership, the Right to Information Act, accrual system of accounting, electronic payments, drawing up work contracts, and procedures for the payment of taxes. The NAARM has organised many of these courses in agricultural research institutions. In March 2008, for example, one was held at the ICAR Research Complex (Goa), for 27 technical and administrative staff of the institute.

http://www.naarm.ernet.in/

PO26: Strengthening of the organisational units of research institutes

Since excessive centralisation and bureaucracy often create difficulties for the organisational units of research institutes (e.g. university departments), administrative and academic activities should be strengthened. This usually involves taking responsibility for decisions regarding, for example, new premises and better equipment, allocation of dedicated staff, autonomous programme management, the establishment of a system of communication and monitoring between central and decentralised units, and more.

PO27: Establishing managing positions responsible for creating and maintaining a favourable work environment

In research organisations it is important to create or strengthen roles responsible for creating and maintaining a favourable work environment, both in large organisations (e.g. universities) and individual departments. To this end, facilitators could be employed to monitor and simplify the functioning of activities and roles, listen to the needs of all, facilitate the flow of communication between people and various working groups, communicate events and opportunities, etc. Examples of the roles carried out by facilitators are shown in the box below, relating to experiences in Kenya.
A CONDUCIVE WORK ENVIRONMENT: EXPERIENCES IN KENYA

Practices

The Egerton University - Research and Extension Division has as one of its aims the creation of a favourable environment for research work offering researchers opportunities to disseminate and publish their scientific products.

The International Centre for Insect Physiology and Ecology (ICIPE) has eight “Research Support Units”, which perform functions ranging from advanced analytical procedures to publishing services. In addition, the ICIPE has diversified its training programmes, adapting them to the needs of different target groups (postgraduate training, professional development for researchers from different countries, non-degree training on research methodology).

From the working documents of the Kenya Pilot Programme (SET-DEV), 2009
**FRAME OF RESPONSIBILITY 6**

**KNOWLEDGE MANAGEMENT AND CIRCULATION**

- **RATIONALE**

The accumulation, storage, manipulation, exchange, dissemination and transfer of scientific knowledge.

An important aspect of scientific mediation is knowledge management and circulation, a set of activities that concerns the accumulation, storage, manipulation, exchange, dissemination and transfer of scientific knowledge, carried out by a research institute or its specific departments, groups, etc.

This aspect of scientific mediation presents several problems. They are weaknesses in knowledge management systems, especially in the area of archiving, and the risk that information is lost; weaknesses in library services, including shortages of books, inadequate space, lack of catalogues, lack of staff, etc; lack of facilities to help researchers publish their findings in foreign or international journals; difficulties in accessing international scientific literature, especially on the Internet, due to access costs and connection problems (especially in a developing country like Kenya); work by national researchers produced and/or published abroad is poorly publicised in their own country, and, therefore, is not available for the national economy and society.

SET-DEV has identified 6 practical options to deal with these challenges.

- **PRACTICAL OPTIONS**

**PO28: Creating or strengthening facilities like resource centres and libraries**

It is vital to create or strengthen facilities like resource centres and libraries in institutions and research centres. As shown by cases examined within the SET-DEV framework (see box), such facilities often playing an active role in updating and establishing links with external networks. These structures should be adequately equipped (including Internet connections, often still expensive in some countries) and should have dedicated staff.
INFORMATION SERVICES: SOME KENYAN EXPERIENCES

Practices

Kenya Agricultural Research Institute (KARI) has set up an Information and Documentation Services Programme to support research activities through the management of internet services, library and database services, and the issuing of scientific publications, packaged according to different targets and purposes. The KARI also participates in several knowledge management and networking initiatives.

Kenya Institute for Public Policy Research and Analysis (KIPPRA) has set up, among other things, internal knowledge management services for researchers and the general public, such as an electronic documentation and information centre (e-library), databases, and a library.

From the final report of work package 1 - “Preparation and start-up of the activities of networking and information gathering” (SET-DEV), 2009

PO29: Training of personnel devoted to knowledge circulation and management activities

It is important to identify and train professionals, within institutions and research centres, to provide services for knowledge circulation and management. To this end, new roles, which did not exist before, can be created and new staff trained, or the functions of existing staff (e.g. archivists or librarians) can be extended. In this framework also research teams should be involved in knowledge circulation by developing their skills in this regard. Also the multilinguism of researchers should be utilised to circulate knowledge in various regional and local languages.

PO30: Creating specific tools to collect and disseminate information on researcher expertise and activities

Useful tools for the collection and dissemination of information on researcher expertise and activities are databases, websites, online CVs, etc. These tools can help publicise the activities of a workgroup or an entire research organisation. An interesting large scale experiment was carried out some time ago: the "Kenya Resources Database", detailed in the box below, which collected gray literature in various scientific fields in this African country.
Kenya Resources Database

Practices

In 1998, Shadrack Katuu, a Kenyan student at the School of Library, Archival and Information Studies at the University of British Columbia (Canada) noted that there were few information resources on scientific production in Kenya available on the Internet. So he created the “Kenya Resources Database”, a web-based static database for Kenyan theses and dissertations in various disciplines: the humanities, social sciences, natural and physical sciences, and technology. It is an instrument that is easy to consult and is used to collect and manage information on scientific production (grey literature) that is not widely accessible and taken into little or no consideration in international bibliometric evaluations.

The “Kenya Resources Database” contains 920 bibliographic records of theses and dissertations by Kenyan authors. Although this was a quasi pioneering experiment, this database represents a useful and significant precedent in knowledge management of grey literature. This experience has been disseminated at the international level by the journal “Information Development”.

Katuu 2002

PO31: Creating opportunities for publications in journals

An important function in knowledge management is the monitoring of existing opportunities for publishing articles in journals. It is a service that can significantly support researchers. For example, Daystar University in Kenya manages various activities to promote the scientific work of its teachers and researchers: publication of in-house journals, publication of monographs, dissemination by means of seminars and conferences, etc. It carries out constant scientific networking activities nationally and internationally.

PO32: Creating opportunities for horizontal interaction among researchers of the same research institute

The experiences of many research organisations around the world in the field of knowledge management show the importance of promoting the circulation of knowledge within a workgroup or a research centre, during informal occasions or small group meetings of people who share common scientific interests. It is therefore important to ensure that work is organised in a way that promotes fruitful horizontal interaction among researchers. This involves, for example, identifying suitable premises (reading rooms, comfortable places to have a coffee, etc), taking advantage of work breaks, promoting opportunities for conviviality, promoting informal discussions among researchers, etc.

PO33: Establishing of consultancy services to advise researchers on critical issues

Since researchers do not often have the time or the opportunity to acquire information on sensitive and constantly evolving issues on the operational side (norms, opportunities for funding or etc.), it might be advisable to set up consultancy offices in institutes, or at least employ staff to support researchers in this activity. Some of the issues that this service could provide could include, for example, intellectual property, regulatory updates, documents on practices and experiences, contacts with experts, etc. The Institute of Life Sciences in Hyderabad, for example, is working in this direction (see also below).
FRAME OF RESPONSIBILITY 7

NEW TEACHING FUNCTIONS

- **Rationale**

One aspect of scientific mediation that is given little consideration pertains the dimension of teaching. SET-DEV findings in India and Kenya demonstrate that the relationship between teaching and research activities is changing, new needs and duties are emerging, and students’ attitudes and orientations are shifting.

The relevant problems include: lack of student involvement in the management and assessment of university didactics, where there is a need for innovative, participatory and inclusive ways of students and teachers evaluation; employment in non-profile sectors among graduates in science subjects, due also to a lack of careers and matching services; lack of teaching resources, equipment, materials, support for students, etc. Tackling these difficulties require introduction of new methodologies for assessing didactic quality that involve students and the creation of placement services to offer job opportunities to graduates. New professional qualifications are also emerging, such as professional mediators, teaching assistants, tutors, higher education experts, placement experts.

To all intents and purposes these changes in teaching are emerging as a frame of responsibility, concerning which some practical options have been identified.

- **Practical Options**

**P034: Strengthening students support services**

Important student support services include guidance, information and job placement as, for example, in the case of Jawaharlal Nehru Technological University, Hyderabad, or the School of Pure and Applied Sciences - Kenyatta University, which has created a network of scientific relations with public research institutions, international bodies and private actors with the aim of establishing contacts between trainees and major businesses in Kenya for potential employment opportunities.

**P035: Creating or strengthening tutoring**

It is essential to ensure structured forms of didactic support for students, especially to facilitate the subjectification of knowledge and, in general, to guide their learning career within the university. It is therefore particularly important to create or enhance tutoring services, with offices, equipment and, above all, suitable staff.
PO36: Creating or strengthening organisational structures for student participation in managing and evaluating didactic activities

It is important to test and strengthen structures for student participation in the management and evaluation of didactic activities. In this context, several experiments have been carried out all over the world to integrate didactics with student contributions. For example, SET-DEV looked at the work of the National Assessment and Accreditation Council (NAAC) in India, which dedicated some programmes to student participation.
FRAME OF RESPONSIBILITY 8

TERRITORIAL AND INTERNATIONAL RELATIONS

Rationale

An emerging challenge for scientific and technological research actors is the growing importance of networking with external actors such as local stakeholders (public administrators, entrepreneurs, local donors, civil society organisations, consulting services, media, etc), as well as international agencies, who, due to global dynamics, are increasingly interested in expanding their local presence (international cooperation organisations, business networks, international NGOs, transnational cultural organisations, etc).

SET-DEV identified numerous challenges related to external networking such as lack of liaison facilities and services between institutions and political and social actors locally and internationally; lack of university facilities to assist scouting by private actors; lack of structures and channels for bilateral communication between research institutions and the community; lack of information on actors working in S&T and their initiatives to set up new relationships and partnerships, etc. To meet these challenges, there have been many attempts to create scientific and institutional networks by universities and research centres; research management officials are taking on the role of mediators between researchers and politicians, support offices are being created for researchers, as also matching services to facilitate meetings and partnerships between actors in a given field (such as biotechnology).

A special, and important, frame of responsibility, therefore, requires research institution to be more open towards external stakeholders, broadening and consolidating their social capital. Accordingly, the following practical options have been identified.

Practical Options

PO37: Establishing roles and responsibilities for relations with local political actors and international cooperation agents

To create in institutes and research centres roles and responsibilities or ad hoc structures to establish and maintain relations with political actors at national level (centrally and locally) and with international cooperation actors. A number of institutions among those examined under SET-DEV (e.g. the International Centre of Insect Physiology and Ecology in Kenya) have structures or professionals dedicated to these types of relationships.
PO38: Establishing roles and responsibilities for relations with social actors

To identify roles and responsibilities or specific structures for relations with local and national social actors. These relations are important not only for scientific production in the strict sense (see area 1) but also for greater territorial coverage. An example is the Institute of Women, Gender and Development Studies at Egerton University (Kenya), which supports the education of girls in the area, with the help of sponsors. Thus, the people or offices responsible can map and identify relevant actors for the institution, facilitating a constant flow of communication and identifying beneficial forms of cooperation.

PO39: Establishing roles and responsibilities for relations with private actors

For the same reasons, research institutions should create roles and responsibilities for developing relations with private actors. In this respect, in the wake of the numerous experiments recorded in India and Kenya, specific offices and services can be set up (see box). These offices or services could, for example, promote research and consultancy partnerships, internships, and channels for graduate placement.

<table>
<thead>
<tr>
<th>RELATIONS WITH PRIVATE ACTORS: JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY IN HYDERABAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practices</td>
</tr>
<tr>
<td>Researchers at this university are encouraged and helped to provide advice to private institutions (as well as to government departments and other organisations) contributing to the academy’s self sufficiency.</td>
</tr>
<tr>
<td>The university is also involved in capacity building programmes for administrative staff, through courses directly conducted by the academic staff. Finally, programmes have been launched to increase the skills of teachers, both through training courses of the recently established UGC Academic Staff College, and by encouraging internships for teachers in the industrial sector.</td>
</tr>
</tbody>
</table>

PO40: Matching services to facilitate meetings and partnerships with actors operating in specific sectors or intervention areas

Where there is a particularly high number of scientific, political, social and economic actors (e.g. in cities such as Nairobi or Hyderabad, which are true international "hubs"), it is important to know about existing opportunities for cooperation. In such cases it is useful to create matching services, to map these actors and facilitate meetings and partnerships with them (e.g. actors operating in specific sectors or intervention areas - health, information, biotechnologies, etc) (see box).
KENYA

**Practices**

Kenya Industrial Research and Development Institute (KIRDI), in its efforts to become a “centre of excellence”, has introduced a new organisational structure which includes, in addition to various departments involved in research and technology transfer, an office providing different services including public relations, together with others (e.g. planning, funding and administration, project management, internal auditing). Kenya Forestry Research Institute (KEFRI) has set up a “Corporate Affairs and Public Relations Unit” in 2005 to make up for organisational shortcomings in networking and development of research work.
In a context in which access to funding is becoming ever more competitive, the design and promotion of new research programmes and projects is increasingly important and even vital for research institutions or their departments.

SET-DEV highlighted that those involved in research are not always prepared for this challenge, which requires serious reflection not only on the ongoing changes in the way research is produced and supported, but also on the possible ethical dilemmas inevitably produced by the diversification of the sources of financial support (e.g. risks of dependence in determination of research agendas and research strategies, risks in intellectual freedom in interpretation and use of results, etc). In addition, specific problems arise, such as lack of fund raising facilities within scientific institutes (funds allocated by the government may sometimes remain unused because universities fail to apply for them), or the lack of competences for planning to obtain available national and international funds. In addition, there is a need to create shared operating procedures and languages among different actors (involved in administration and scientific production) within research institutes.

Thus, in this domain, structures, services and skills are needed that are seldom available in research institutions. In any case, according to some SET-DEV sources, there seems to be a greater awareness of the ethical and social aspects involved in the acceptance of new sources of funding.

Overall, therefore, this is an essential frame of responsibility, concerning which the following practical options have been identified.

**PO41: Creation of offices to assist academics with research design and funding**

It is important to create special offices equipped with the necessary facilities and personnel in universities, departments, independent research centres, etc. to support research design and funding to compete in the international research market. For example, the School of Engineering - University of Nairobi have staff that systematically carry out fund raising activities and handle relations with businesses that could potentially benefit from the school’s research and consultancy services. Another example is detailed in the box below.
Fundraising at the Institute of Life Sciences in Hyderabad

Practices

The Institute of Life Sciences in Hyderabad is working to create an environment conducive to research, in terms of institutional form (a "flexible" partnership between a government-state body, a private body and a research centre), its position in the Hyderabad University campus, infrastructure quality and work organisation. The institute also has an office to support researchers in fundraising (see below) and contacts with scientific community networks.

Giving to ILS:

“The Corporate Development Office is working to build strong, long-term relationships with private individuals, companies, foundations and organisations with the interest and commitment to support the research at ILS. The aim of ILS’s fundraising campaign "Breakthroughs for Life" is to attract donations to research areas in which our scientists have the potential to make crucial medical discoveries in the coming years.

The interest and enthusiasm we’ve encountered among individuals, companies, foundations and organisations for ILS’s research indicate great opportunities for the future - opportunities for medical breakthroughs that will lead to considerable improvements in life quality for patients and their families and also for great benefits to society at large.

Our researchers have the expertise, the ambition and the motivation to make these breakthroughs a reality - all that is missing are those extra resources that will drive our research to the next level. Through your support, we will reach that level.”

www.ilsresearch.org

PO42: Establishing the role of research design manager

In addition to creating special offices, it is also recommended to create and consolidate the professional role of research design manager to promote and coordinate research design and funding within a given scientific organisation. There are more and more educational opportunities for a career in this profession. On the basis of LSC experience in Europe in this area, some requirements are needed such as: interpreting the social reality in which design activities take place; building capacities that are functional to design; understanding and overcoming the obstacles which may be detrimental to design activities (for more details, see: http://www.scienzecittadinanza.org/public/GEFERLG.pdf.

PO43: Training or refresher courses on principles of research design for researchers

It might be a good idea to introduce specific training or refresher courses on research design in research institutions. It is important to involve not only officials in dedicated offices in training activities (see above), but also individual researchers who must be able to formulate their research projects in a way that can be understood and appreciated by funding bodies. The themes for these initiatives could include, for example: updates on funding agency programmes; information on laws and regulations for the disbursement of funds; information on successful experiences in the field of research design.
In India the research councils which focus on science and technology research and developing technology at the state and/or regional level are the main sources of knowledge management and circulation in the issues concerning the mediation. First among these are the CSIR - Council of Scientific & Industrial Research, the Indian Council of Medical Research (ICMR) and the Indian Council of Agricultural Research (ICAR). These have their own research institutes and also financially support research at universities as well as network projects involving scientists from each other's institutes and from industrial research centres.

The Indian Council for Social Science Research and the University Grants Commission are the principal funding bodies for the Social Science research, ICSSR – (http://www.icssr.org) University Grants Commission (UGC - http://www.ugc.ac.in). For the Sciences there are six Science academies, several discipline-based and professional bodies to set standards in research and evaluation of research and ethics in research:

Indian Academy of Sciences,
National Academy of Medical Sciences,
Indian National Academy of Engineering,
Indian National Science Academy and
National Academy of Agricultural Sciences, all New Delhi-based, and
Allahabad-based National Academy of Sciences.

Schemes have been evolved to attract young students into scientific careers is through programmes such as the Kishore Vaigyanik Protsahan Yojana initiated by the Government of India to encourage young students to join in Sciences, Engineering and Medicine courses and to take up careers in research in these fields. The programme aims to identify and select students who demonstrate talent and aptitude, and encourage and assist them in pursuing research careers in their chosen fields. This programme hopes not only to assist the students to realize their potential, but also to ensure that the best scientific talent is tapped for research and development establishments in the country: a generous scholarship is provided (up to the Pre-Phd level) to the selected students. The selection of students is from those who are studying +1, +2 (11th or 12th standard), any under graduate program including First/Second year Engineering/Medicine and selections are carried out by IISc (Bangalore), IIT-Bombay (Mumbai), and ICMR (New Delhi), respectively, in association with two Zonal Centres one at Kolkata (Indian Institute of Science Education Research, Kolkata) and another at Mumbai (HBCSE, TIFR). There are special groups or committees set up at IISc, IIT and ICMR which screen the applications, conduct interviews at various centres, make the final selection and all the associated follow-up activities.

A National Science Olympiad Programme covering Mathematics, Physics, Chemistry and Biology is operational in the country with the active support of Department of Science & Technology, Department of Atomic Energy and Ministry of Human Resource Development. The programme aims at promoting excellence in science among pre-university students and selecting teams to represent India at the respective International Olympiads.
The University Grants Commission has been making proactive efforts to upgrade the knowledge and skills of faculty members in the institutions of higher education. For the purpose of organising orientation and refresher courses for in service faculty members, the UGC has established and funds a network of 66 Academic Staff Colleges across the country. Besides, the UGC has also identified as many as 5 universities/institutions to organise and conduct refresher courses for faculty members in their chosen areas of specialisation during 2008-2009.

There are several mechanisms which work in India towards facilitating meetings and partnerships with actors operating in specific sectors such as the FICCI – the Federation of Indian Chamber of Commerce and Industry. FICCI works closely with the government on policy issues, enhancing efficiency, competitiveness and expanding business opportunities for industry through a range of specialised services and global linkages. It also provides a platform for sector specific consensus building and networking.

In specific sectors there are institutions that seek to work as liaising bodies. For example, the Biotech Consortium India Limited - BCIL was incorporated as public limited company in 1990 and promoted by the Department of Biotechnology, Government of India.

Excerpts from University of Hyderabad SET-DEV working papers
LESSONS LEARNT ON SCIENTIFIC MEDIATION

LESSONS LEARNT ON SCIENTIFIC MEDIATION: KENYA

- There is considerable scope for local STR organisations to use the international hub provided by Nairobi

  Numerous international and regional research organisations have their headquarters based in Nairobi. There is considerable scope for local research institutes and other technology-oriented bodies within the government and non-government sectors to take greater advantage of this international hub, not only for the networking and partnership opportunities it offers but also as a potential source of financial and technical resources.

- There is further scope for building partnerships between overseas universities/research centres and locally-based organisations in relation to STR/STI

  Opportunities for fostering partnerships between overseas universities/research centres, which are undertaking STR, and locally-based organisations, which are keen to take forward scientific and technological innovations, should be further pursued.

LESSONS LEARNT ON SCIENTIFIC MEDIATION: INDIA

There is a need to improve management of research, in research information system in India, so that the R & D Institutions have access to information about research activities in other institutions.

Awareness-raising courses and seminars for officials and administrators of management of research and R & D culture is needed.

There is a need to establish institutionalised role of S & T managers in academia. The role of S & T managers includes providing patent related information enabling scientists to file patents and intellectual property management in general in such institutions.

Improving and creating opportunities for interaction among researchers working in similar areas on a regular basis is also a necessity.

For further information, see also:

Area 3: frame of responsibility 12
Area 5: frames of responsibility 25, 26, 27
Area 6: frame of responsibility 33
Area 7: frame of responsibility 36
SUMMARY

Area 2 - Scientific Mediation

Frame of responsibility 5:
General management and administration of research

Practical Options
PO23: INSTITUTIONALISE THE ROLE OF SCIENCE MANAGER IN RESEARCH INSTITUTES
PO24: INTRODUCING AWARENESS-RAISING COURSES AND SEMINARS FOR OFFICIALS AND RESEARCHERS ON
MANAGEMENT AND ORGANISATIONAL CULTURE
PO25: TRAINING OR REFRESHER COURSES FOR ADMINISTRATIVE AND TECHNICAL STAFF
PO26: STRENGTHENING OF THE ORGANISATIONAL UNITS OF RESEARCH INSTITUTES
PO27: ESTABLISHING OF MANAGING POSITIONS RESPONSIBLE FOR CREATING AND MAINTAINING A
FAVORABLE WORK ENVIRONMENT

Frame of responsibility 6:
Knowledge management and circulation

Practical Options
PO28: CREATING OR STRENGTHENING FACILITIES LIKE RESOURCE CENTRES AND LIBRARIES
PO29: TRAINING OF PERSONNEL DEVOTED TO KNOWLEDGE CIRCULATION AND MANAGEMENT ACTIVITIES
PO30: CREATING SPECIFIC TOOLS TO COLLECT AND DISSEMINATE INFORMATION ON RESEARCHER
EXPERTISE AND ACTIVITIES
PO31: CREATING OPPORTUNITIES FOR PUBLICATIONS IN JOURNALS
PO32: CREATING OPPORTUNITIES FOR HORIZONTAL INTERACTION AMONG RESEARCHERS OF THE SAME
RESEARCH INSTITUTE
PO33: ESTABLISHING OF CONSULTANCY OFFICES OR ROLES TO ADVISE RESEARCHERS ON CRITICAL ISSUES

Frame of responsibility 7:
New teaching functions

Practical Options
PO34: STRENGTHENING STUDENTS SUPPORT SERVICES
PO35: CREATING OR STRENGTHENING TUTORING
PO36: CREATING OR STRENGTHENING ORGANISATIONAL STRUCTURES FOR STUDENT PARTICIPATION IN
MANAGING AND EVALUATING DIDACTIC ACTIVITIES

Frame of responsibility 8:
Territorial and international relations

Practical Options
PO37: ESTABLISHING ROLES AND RESPONSIBILITIES FOR RELATIONS WITH LOCAL POLITICAL ACTORS AND
INTERNATIONAL COOPERATION AGENTS
PO38: ESTABLISHING ROLES AND RESPONSIBILITIES FOR RELATIONS WITH SOCIAL ACTORS
PO39: **Establishing roles and responsibilities for relations with private actors**

PO40: **Matching services to facilitate meetings and partnerships with actors operating in specific sectors or intervention areas**

**Frame of responsibility 9:**

*Research design for funding*

**Practical Options**

PO41: **Creation of offices to assist academics with research design and funding**

PO42: **Establishing the role of research design manager**

PO43: **Training or refresher courses on principles of research design for researchers**

**Lessons learnt Kenya**

- There is considerable scope for local STR organisations to use the international hub provided by Nairobi.
- There is further scope for building partnerships between overseas universities/research centres and locally-based organisations in relation to STR/STI.

**Lessons learnt India**

- There is a need to improve management of research, in research information system in India, so that the R & D Institutions have access to information about research activities in other institutions.
- An awareness-raising activity for officials and administrators of management of research and R & D culture is needed.
- There is a need to establish institutionalised role of S & T managers in academia.
- Improving and creating opportunities for interaction among researchers working in similar areas on a regular basis is necessity.
Chapter Three

Area 3

Scientific communication

What do people think of science, technology and innovation? Which are the visions of STR circulating in society? Which are the actual communication flows within scientific institutions and between them and the “outer” world? Which links are there between scientific communication and individual or collective responsibility towards STR? These are crucial questions considering the lack of confidence, distrust or disregard showed by public at large, social and economic actors and often even by decision makers towards scientific research. In this sense, scientific communication determines the fate of STR socialisation.

For a long time now, scientific communication has been understood as an activity aimed at promoting and disseminating scientific and technological contents. It was normally carried out by a narrow group of experts who often treated their audience with disdain. The most important component of this approach has been the model entitled “Public Understanding of Science” (PUS). It is a shorthand term for all forms of outreach by the scientific community, or by others on their behalf (e.g., journalists, science writers, museums, event organisers), to the public at large, aimed at improving the understanding of scientific matters by so-called “non experts”. It has some merits, but it is undeniable that it incorporates real mistrust of the public and its knowledge. Its other limitation is promoting a one-way top-down transfer of information and notions.

By contrast, some other concepts such as the “Public Understanding of Research” – PUR or the “Public Understanding of Current Research” – PUCR increase in popularity. They are based on a strong commitment of the public at large at all stages of scientific research and not just when research is completed. In comparison to PUS these concepts are far more helpful, in promoting an open and participatory debate on the role of science, technology and innovation in society. This was the attitude implemented in the Manifestos developed within the SET-DEV framework (see the box).

On this basis, one can say that scientific communication must be seen as a tool for constructing a stronger and more widespread responsibility towards research, involving several political and social actors. In fact, STR is a “collective enterprise”, functioning only if a wide range of actors with different roles is actually involved (i.e. scientists, politicians, public authorities and public officers, information professionals and journalists, enterprises, etc.). In such a perspective, the representations of science and technology in public opinion, as well as the positions of collective actors engaged in STR appear to be particularly salient.

This requires to strongly broaden the horizons in defining what scientific communication is and what it includes. As already suggested in the Introduction, several levels of scientific communication may be identified: “intra-epistemic” communication, i.e. passage of knowledge and information among researchers within the same research domain; “trans-epistemic” communication among actors from diverse disciplinary and research domains, that also can belong to extra-academic institutions; “network” communication, that also in-
volves the many actors engaged in the supporting activities required by research (i.e. managers, evaluators, technical personnel, administrative staff, etc.); “social communication”, in which the contribution provided by extra-academic organisations (such as associations, civil society, companies, etc.) in shaping scientific knowledge is recognised; “political communication” between the scientific community and the political decision makers; and, finally, “general communication”, which regards the relationships between scientific community and public opinion.

On the basis of this typology and other elements emerged from SET-DEV, frames of responsibility connected to scientific communication have been identified, each focused on a specific set of risks and opportunities. These frames are related to the levels of scientific communication outlined above, i.e.:

- Intra-epistemic communication;
- Trans-epistemic communication;
- Network communication;
- Social communication;
- Dialogue among decision makers and researchers;
- General communication.

The other two frames of responsibility concern:

- researchers’ attitude to scientific communication;
- relevance and accessibility of scientific communication.

On the following pages, these frames of responsibility will be dealt with in detail.

**COMMUNICATION AND PARTICIPATION AS INTEGRAL PART OF THE RESEARCH:**
**ELEMENTS FROM THE “MANIFESTOS”**

The experience of SET-DEV allowed to highlight the importance of a multidimensional communication model capable of involving a plurality of players both within and outside scientific institutions.

As the *Indian Manifesto on Science and Technology* points out, the public (and its knowledge) is to be considered as an integral part of research, and not merely a “social lubricant” of decision making mechanisms or managerial decisions of technocratic type.

For its part, *The African Manifesto for Science, Technology and Innovation* stresses the need for viewing science, technology and innovation as the output of the interaction among the actors of a “quadruple helix” involving university, industry and decision makers (i.e. those involved with that some refer to as “triple helix”) and the civil society organisations, which are bearer of views, knowledge and experience indispensable for the advancement of knowledge and its rooting in society.
"Intra-epistemic" communication takes place among researchers who belong to the same scientific discipline (e.g. sociologists, or agronomists).

This form of communication is still the main factor for the constitution and validation of scientific facts through information exchange and peer review. However, as emphasised in various initiatives promoted by SET-DEV, this type of communication, despite its importance, faces many obstacles, ranging from researchers’ reluctance to share the results of their work for cultural reasons, for example, to the lack of opportunities and facilities for networking with colleagues, or publishing books and articles. Together these obstacles create a situation of high risk for scientific research.

An important frame of responsibility for the scientific communication of STR, therefore, involves fostering "intra-epistemic" communication. To this end, the following 3 practical options can be identified.

**PO44: Promoting permanent structures for communication between researchers in the same discipline**

Creation of permanent or semi-permanent structures for communication between researchers working in the same discipline. These could include, for example, networks, science groups, clubs, etc. operating at local or national level. These structures can materially facilitate intra-disciplinary exchanges and foster attitudes and models that are more open and oriented towards sharing information and experiences. An interesting example in the field of agronomic studies is the Kenya Agricultural Information Network described in the box below.
The Kenya Agricultural Information Network (KAINET) was set up in 2006 to promote the exchange of information among stakeholders in the agricultural sector. The KAINET is based on the Kenya AGRIS Pilot Project and seeks to institutionalise a place for the collection of agricultural information and support the development of strategies and policies for information and communication management at the national level and in individual institutions. These strategies aim at promoting new skills for the management and sharing of information in agricultural organisations (mostly research institutions). The first part of the project was dedicated to raising awareness in the institutions involved, assessing training needs and implementing capacity building activities, while the second phase was devoted to developing shared strategies for KAINET and for individual institutions, which was also done through the write-shop technique.

KAINET, whose activities are still in the development stage, has already been joined by 5 national institutions: KARI, Kenya National Agricultural Research Laboratories (KARI-NARL), Kenya Forestry Research Institute (KEFRI), the Ministry of Agriculture (MoA) and the Jomo Kenya University of Agriculture and Forestry (JKUAT).

http://www.kainet.or.ke/

**PO45: Supporting researchers in publishing their work**

Given the difficulty that researchers find in publishing their work, it is important not only to set up opportunities and services (see Area 2) but also to offer personal encouragement. This can usually be done, for example, through incentives that are organisational (such as allowing researchers more time to write), financial (awards for quality publications) and symbolic (greater prestige and visibility). For example, researchers working for ICIPE (Kenya) on projects involving the development of technologies to combat parasites have been given the opportunity to publish a total of 16 articles in scientific journals over 12 years.

**PO46: Introducing new web applications and services**

To foster communication among researchers in the same discipline, or those that share a common area of interest, new web applications and services can be set up or strengthened. These could include, for example, online forums, virtual groups, wiki-portals and more, to present and discuss issues and problems related to the practice of research. In addition, some large national research organisations (e.g. NISTADS in India) provide information-rich web portals and services, listing conferences and research opportunities, bibliographies, literature updates, etc. (http://www.nistads.res.in). Obviously, these tools can also be used for other forms of scientific communication (see below).
FRAME OF RESPONSIBILITY 11

TRANS-EPISTEMIC COMMUNICATION

▪ RATIONALE

"Trans-epistemic" scientific communication occurs between individuals belonging to different scientific disciplines, often on behalf of institutions that are not academic.

This type of communication is increasingly important due to the growing importance of multi-disciplinary research programmes and the need for closer interaction and collaboration between different actors. This form of communication is crucial for the socialisation of STR as it helps bringing together very different types of knowledge. This may facilitate the production of creative and innovative theories and knowledge, at times even breaking established dominant paradigms.

Many obstacles to trans-epistemic communication were found during SET-DEV activities, such as the lack of widespread awareness and opportunities for meeting and exchanging ideas. In the absence of such communication, significant opportunities for enrichment and inspiration are missed. This makes the promotion of "trans-epistemic" communication an important frame of responsibility for the scientific communication. To this end, some practical options can be identified, in addition to those already mentioned for intra-epistemic communication and some suggested in Area 1 on the contextualisation of research.

▪ PRACTICAL OPTIONS

PO47: Raising awareness among researchers about the importance and benefits of trans-epistemic communication

It is important to make researchers aware of the importance and benefits of trans-epistemic communication. This can be achieved by arranging meetings and seminars. To be even more effective, this awareness should be accompanied by the practical experience of meeting and collaborating with researchers from other disciplines and experts in fields other than science, as happened in various activities under SET-DEV in India and Kenya (see box).
**TRANS-EPISTEMIC COMMUNICATION IN AN AGRICULTURAL PROJECT IN KENYA**

**Practices**

As part of a project to combat parasites, called “Push and Pull Technology” (PPT), ICIPE adopted a multidisciplinary approach from the beginning, to include not only a biologists and an entomologists but also economists and social scientists. The ICIPE research team worked with social scientists to fully understand the social component of socialising PPT. ICIPE also closely engaged KARI and Ministry of Agriculture through the entire process.

From the: Guidance note. Core principles and socialisation processes: science, technology and innovation, SET-DEV Nairobi

---

**PO48: Creating common languages and environments to foster dialogue among researchers of different disciplines**

To facilitate communication among researchers of different disciplines a common language and an appropriate interactive environment needs to be created. In this respect, opportunities for interaction should be encouraged as much as possible, and, above all, conditions for dialogue and exchange should be created, such as regular conferences, portals and web sites, exchange visits, etc. There have been some interesting experiences in this regard in Andhra Pradesh (see box).

---

**DEVELOPMENT OF "METAPERSPECTIVES"**

**Practices**

According to some, in order to facilitate the multidisciplinary dialogue and formulate concepts and classification systems it is essential to identify a domain and/or problem that is intelligible to all (“metaperspectives”). On the basis of various experiences in Andhra Pradesh, this makes it possible to formulate a common language among actors having different cultures (e. g. biologists and embreeders). This requires complex, but necessary forms of dialogue and exchange among actors.

Reece, Haribabu 2007

---

**PO49: Promoting multidisciplinary publications**

It is important to foster multidisciplinary publications such as books or magazines. These publications can concern either multidisciplinarity in general or the application of multidisciplinarity in specific areas, such as health, transport, climate, agriculture, etc. An example of the latter is the online magazine “The African Journal of Food, Agriculture, Nutrition and Development” (AJFAND), a peer reviewed journal with a global reputation, published in Kenya by the Rural Outreach Programme (ROP) (http://www.ajfand.net).
"Network communication" takes place in the context of "collateral" activities required to carry out research; it involves actors such as research managers, technical and administrative staff, suppliers, consultants, and those responsible for the disbursement and administration of research funds. Within this mode of communication significant knowledge management activities may take place (see Area 2).

The main obstacle to this form of communication is the fact that it is often poorly understood and therefore there is a risk that it is left to chance and to informal dynamics that are poorly controlled and managed. This may produce organisational problems and conflicts of various kinds.

It is, however, important to fully exploit the potential and opportunities for interaction between different actors involved in the production and management of scientific knowledge. Networking is, therefore, a specific frame of responsibility to enhance the STR. To this end, the following practical options can be identified, which can be added to those detailed in Area 2.

### Practical Options

**PO50: Experimenting with new forms of information exchange between researchers, management and administration**

It is important to promote communication between researchers, managers and administration and technical staff. Actions that can facilitate greater interaction and collaboration between these actors include (Bijker, d’Andrea 2009): joint assessment of the way organisations operates; meetings to identify procedures to facilitate the work of all staff members; promotion of meetings to raise awareness and provide information on research management, open to both researchers and administrative and technical staff.

**PO51: Organising initiatives for interaction and dialogue between science managers and publishing managers**

It is essential to identify and expand communication channels between research institute managers and the publishing industry. In this regard, initiatives for dialogue and networking between these types of actors can be very useful as is demonstrated by the experiences of different Indian and Kenyan actors studied during SET-DEV. These initiatives usually take the form of seminars, visits, informal meetings, regular briefings on research carried out, etc.
**P052: Strengthening communication with funding institutions**

Managers of research institutes should establish firm relations with donor institutions (government agencies, private institutions, international agencies, etc). As shown by the experience of several organisations including many of those examined by SET-DEV in India and Kenya, it is important to establish permanent forms of communication between research institutes and donor institutions. This can be done through the exchange of documents and information, the production of policy briefs, participation in meetings and seminars, direct informal exchange, and more. As demonstrated by ICIPE in Kenya, it is essential to involve interlocutors in this kind of communication (see box).

<table>
<thead>
<tr>
<th>COMMUNICATION WITH DONOR AGENCIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practices</td>
</tr>
<tr>
<td>For the International Centre of Insect Physiology and Ecology (ICIPE), as shown in a SET-DEV case study in Kenya, a key highlight is the engagement of donors throughout the research project so that they can fully understand the research and, whenever any shortcomings are identified, they can engage in finding solutions. “We are trying to create a common path with donors. We try to involve the donors in the research process, so that they are always aware of the status of the project. The donors have to be kept interested with new science, we need to come up with ways to solve a problem and really involve the donors in these challenges. If I have to make a recommendation to other organisations, I would say that they should keep donors informed to see the real changes.”</td>
</tr>
<tr>
<td>From the: Guidance note. Core principles and socialisation processes: science, technology and innovation, SET-DEV Nairobi</td>
</tr>
</tbody>
</table>
In recent years there has been an increasing need for greater involvement of social and economic actors, such as businessmen, civil society organisations and other social groups, in the dynamics of STR management. Such involvement is not just about building an *a posteriori* consensus on the content and output of scientific activity but also, and above all, consensus "before" and "during" the production of scientific knowledge and innovation, through knowledge exchange, guidance and evaluation. This exchange may be termed "*social communication*" that is used to define the social demands made of SRT and thus to promote the contextualisation of scientific knowledge and the development of technologies appropriate to different contexts.

It is clear that when this type of communication is underestimated or lacking, there is a serious **risk** that science and technology become **separated** or deviate from the needs of society. For example, citizens are usually excluded from decisions concerning technological options or the identification of technological priorities and opportunities. In addition, they are often not adequately informed of the **effects** that some technological options (e.g. in agriculture or health) could have directly or indirectly on their lives. Not infrequently stakeholders involved in consultations over technological options are not provided with all necessary information. This generates disaffection with science and technology communication at the local level.

As can be seen from information gathered under SET-DEV, it is not easy to promote this type of communication because of the still rigid distinction between "experts" and "lay persons" in STR communication due to entrenched cultural and operational models in the research community, and also to a degree of reluctance on the part of social actors, such as companies or NGOs, to collaborate with researchers. However, this project has identified **significant cases of social communication**, as a specific frame of responsibility.

The following **practical options** have been identified.

**P053: Promoting opportunities for dialogue with stakeholders on the state of the art in key research sectors and the exploitation of research findings for the benefit of their community**

It is important to involve different local actors in assessing the current state of research in specific areas, and in identifying which research products can be used for the good of the
community. To this end, seminars and panels can be organised at local level with researchers, decision-makers, entrepreneurs, civil society representatives and other stakeholders (see boxes below). Discussions in these meetings may focus on, for example, how specific research results can solve specific problems in areas such as agriculture, health, water resource management.

**CREATING A COMMON GROUND FOR DIALOGUE: A RESOURCE CENTRE ON WATER**

**Practices**

Particular attention to scientific communication aspects is paid by different civil society organisations, carrying out research on approaches, channels and appropriate languages for interaction between the world of research and different population groups, especially if they are operational targets or partners. For instance, in Andhra Pradesh (India) the Watershed Support Services and Activities Network (WASSAN) has created a resource centre on water resource management to foster dialogue and create a common ground for dialogue among researchers, activists and policy makers.

www.wassan.org

**AN EXPERIMENT IN SCIENTIFIC COMMUNICATION AT THE MASS LEVEL: BHARAT JAN VIGYAN JATHA**

**Practices**

An experiment worth mentioning, which was conducted some time ago in India, was the "Bharat Jan Vigyan Jatha." This interactive scientific communication campaign, perhaps unique in the world, was promoted and coordinated by the National Council for Science and Technology Communication (NCSTC) between 1987 and 1992 in India, in collaboration with 26 organisations belonging to the People's Science Movement. The programme involved groups of scientific communicators going from village to village to interact with people and discuss scientific issues relevant to everyday life. Topics discussed covered the areas of health, water, the environment, and appropriate technology. Issues such as superstition, scientific thought and literacy were also addressed. Different media were used in the initiative, such as exhibitions, slide shows, popular lectures, film-shows, street plays, S&T Toys/Models/Kits, aero-modelling, sky-watching, quizzes, contests, competitions, songs, and dramas.

The initiative involved 2500 agents, including government agencies and NGOs, who visited almost 40,000 villages in 400 districts, encompassing almost one third of the population of the country. Following this impressive work, an organisation was formally created to organise other activities in this field.

Patairiya 2002

**P054: Promoting forms of citizen consultation about priorities, dilemmas, risks and opportunities of technological options**

It is important to consult stakeholders on priorities, issues and ethical dilemmas concerning the application of certain technologies. This typically involves information and awareness raising meetings, consultative assemblies, informal meetings in the places where technology is to be tested and/or applied, and so forth (see the participatory methodologies presented in Area 1 – PO4; see also Area 6). The case study on hysterectomy, conducted in India
under SET-DEV, shows the importance of in-depth exchanges of opinions with social actors on existing technological options (see box)\(^{10}\).

**Hysterectomy in India: A case study**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The investigation of the practice of unindicated medical hysterectomy in rural Andhra Pradesh is a good example of how the easy access to technological systems of diagnosis has led to medical science taking a back seat and the dynamics of the industry determining the path of treatment. The practice of unindicated hysterectomy as was evident in the focus group discussions has shown how despite the absence of scientific basis for such interventions the practice is ubiquitous especially with people who are vulnerable due to their economic status and because of their gender. The case study illustrates how techno science, ethics and violence can in today’s India create an unhealthy practice that needs the attention of scientists and technologists. It also shows the importance of technological responsibility best exemplified by the committed work of professional doctors as possibly a more effective way of addressing the situation than the legal path of banning practice. The idea of technological responsibility and socialised scientists in action is one of the contributions of the case study to the manifesto. The other is the need to look at the gender aspects of science more closely.”</td>
</tr>
</tbody>
</table>

Excerpts from: KICS, Piloting Knowledge Swaraj: A handbook on Indian Science and Technology, within the framework of SET-DEV project, 2010

**PO55: Experimenting new tools to expand and democratise the debate on science and technology**

It is important to create new and appropriate means of communication among different stakeholders to expand and democratise the debate on STR. A significant example of this is the experience of the Knowledge Network on Civil Society (KICS) in India, which uses the Internet extensively to promote and strengthen dialogue on the relationship between science, technology, and society (see box).

\(^{10}\) In India there are also efforts to incorporate elements from the “day”/indigenous midwifery tradition (e.g. delayed cord cutting and placental resuscitation) to enhance infant survival. This is a form of “inter-epistemic” communication (comment by Leena Abraham) (see also Area 8).
**KICS: A DISCUSSION FORUM ON SCIENCE AND DEMOCRACY**

**Practices**

Knowledge in Civil Society (KICS) is a network promoted in 2005 by CWS for promoting conversations on science and democracy in India. The network comprises activists involved in people friendly science and technology practices and policies and academics (Indian and European) in the broad area of science studies. Its activities include research, seminars, workshops and a website that presents documents and a discussion forum on the relationships between science, technology and society. KICS is a partner of the SET-DEV project.

KICS fosters the collection of documents and the reflection about topics that are not always considered and adequately discussed in the public debate on science and technology, such as the relationship between science and democracy. KICS website, which is in constant evolution, represents an interesting example of electronic communication to create networks and foster the exchange among actors from various environments, with diverse experiences and skills.

www.kicsforum.net/index.php

**CIVIL SOCIETY ORGANISATIONS IN KNOWLEDGE PRODUCTION**

Gibbons (1994) observes that earlier the academics were the locus of knowledge production, which is Mode 1. In Mode 2 the industrial R & D became a site of production. Nowotny et al. (2002) refers to the demand for democratisation of scientific expertise with an increasingly vociferous civil society which is questioning the authenticity of the public nature of science. There is an increasing demand for the participation of all sections of society in science and discussing its role, and this is leading to an increasing pressure on science as an institution. In this context, there is a trend in which the Civil Society Organisations (CSOs) have also become sites of knowledge production. We may call this as Mode 3 production. Mode 3 production of knowledge is through the collaboration between academia, industry and the civil society organisations, one such example is the Centre for Science and Environment (CSE). They conduct innovative research and also critically evaluate the scientific claims of research by the various scientific organisations.

Excerpts from University of Hyderabad SET-DEV working papers

**PO56: Fostering programmes to “return” the results of scientific research to stakeholders**

When implementing projects and research activities that involve stakeholders as sources of information or as partners in experimentations it is necessary to ensure that any findings and/or decisions are shared, as far as possible with them. This is a mark of respect for the people or communities involved. This can be done through meetings, seminars and other information exchange activities, as experimented, for example, in a SET-DEV case study in Kenya concerning an ICIPE agricultural project: ICIPE not only informed farmers of the results of experiments carried out with their participation, but also explicitly acknowledged the farmers' knowledge in its scientific reports and publications. Another example is detailed in the box below.
Practices

When agronomists visit farmers, they collect information that can be used in their research programmes (e.g. laboratory samples), but farmers rarely get feedback on research results. In addition, scientific information and concepts are often too abstract and detached from daily life. Scientists in Kenya have therefore tried to give farmers direct feedback on research results, in the framework of the Integrated Soil Fertility Management (ISFM), a knowledge-intensive approach, which by combining indigenous and scientific knowledge aims to raise productivity levels without altering natural resources. Despite farmers’ readiness to benefit from research results, the standard forms of representing results (lists of data) seemed ineffective. Therefore scientists held workshops and meetings with farmers to “rebuild” the fundamental concepts of research on a common basis, with the aid of diagrams and drawings, and the use of analogies and metaphors taken from everyday life.

Experience has shown that farmers are interested in making direct contact with scientists to discuss complex issues and understand the processes underlying soil fertility. Furthermore, this allows scientists to improve their understanding of the way farmers’ everyday choices affect soil fertility.

Tittionell P., Misiko M., Ekise I., 2008
http://library.wur.nl/WebQuery/wurpubs/lang/374767

PO57: Promoting the dialogue on STR among local communities

It is important to promote opportunities for different communities to meet and talk about STR. Initiatives of this kind were examined in case studies in India and Kenya. These initiatives can focus on STR topics or issues of common interest, or involve exchanges on experiences of concrete initiatives already undertaken or planned. This can be done through meetings, missions, and on-site visits.
FRAME OF RESPONSIBILITY 14

DIALOGUE AMONG DECISION MAKERS AND RESEARCHERS

**RATIONALE**

Policy makers and researchers usually do not talk much to each other, with the result that a country’s development policies miss expertise and resources of crucial importance. This happens for many reasons (see also Area 6): differences in education and culture, incompatible modus operandi, different agendas, different languages, or lack of opportunities to meet. In addition, one of the reasons why politicians find it difficult to take research reports into account is that they do not always contain strategic proposals or concrete operational guidelines. Another obstacle to dialogue between policy makers and researchers is the fact that decision-makers sometimes have no overall view of research activities and potential in a given country or in a given decentralised state or region.

The creation of a meeting ground between decision makers and researchers can help to foster not only dialogue between these two types of actors, but also the mechanisms of science communication in general making this an important frame of responsibility to keep in mind.

To this end, SET-DEV identified several positive experiences during its work suggesting the following practical options.

**PRACTICAL OPTIONS**

**PO58: Promoting seminars and other forms of information exchange for policy makers and researchers**

Since one of the reasons for mistrust between decision-makers and researchers is the lack of opportunities to meet, it is important to create these opportunities, such as seminars, meetings and capacity building programmes, like those promoted by the ATPS in various African countries (see box). These meetings could focus on STR policy, specific topics related to specific areas of research, or even raising general awareness, for example, of the view that science and technology is deeply embedded in society.
CAPACITY BUILDING FOR AFRICAN LEGISLATORS

Practices

ATPS is collaborating with the UK Parliamentary Office of Science and Technology (UK-POST) on a new project on Innovative strategies to Enhance Capacity to apply Research Evidence in Policy making. The program has received support for the preparatory phase. It seeks to enhance the capacity of African legislators to use health policy and health systems research in evidence-informed scrutiny of government by conducting activities to enhance the knowledge, skills and attitudes of legislative staff (who have a key role to play in providing legislators with objective information and advice).

http://www.atpsnet.org

PO59: Sensitising decision makers to the usefulness of research findings

Steps should be taken to raise awareness among decision-makers to help them to make appropriate and informed use of research results. International experience as well as experiences in SET-DEV areas shows that various types of intervention are possible, for example, conferences and meetings, different forms of lobbying, mobilisation of public opinion and the media on certain crucial issues, and more.

PO60: Develop mechanisms to present research results to politicians

It is essential for researchers to seriously consider improving the way they communicate their research results to decision makers. To this end, appropriate and efficient tools should be developed to present these results, such as policy briefs (see box).

THE POLICY BRIEF

The policy brief is a document which outlines the rationale for choosing a particular policy alternative or course of action in a current policy debate. According to some, a policy brief must be: focused, professional (not academic), evidence-based, limited, succinct, understandable, accessible, promotional, practical and feasible.

http://www.policy.hu/ipf/fel-pubs/samples/PolicyBrief-described.pdf

PO61: Establishing a national database of active researchers

Particularly useful instruments for decision makers are databases containing information on ongoing research programmes and research actors carrying them out. These databases should be accessible to decision makers and be user-friendly to make it easy to identify the knowledge available in a particular field of research, identify research strengths and weaknesses, find researchers and experts who can assess and advise on certain issues, and more. An example of such a tool is the gray literature database "Kenya Resource Database", detailed in Area 2.

PO62: Creating national agencies for the management of scientific communication policies

Another form of dialogue between policy makers and researchers is the joint management of scientific communication policies. In India, for example, an important role is played by organisations such as the Department of Science & Technology (DST), Ministry of Science &
Technology (one of its mission is to "popularise" science and technology), the Council for Scientific and Industrial Research (CSIR) (part of the brief is to promote scientific and technological culture), or the National Council for Science and Technology Communication (NCSTC), the National Council of Science Museums and the National Institute of Science, Technology & Development Studies (NISTADS). Available positive experience suggests that it is beneficial to set up, possibly even within existing agencies, national coordination and support organisations (or networks of organisations) for all stakeholders (public and private) operating in the field of science communication, especially to assess the impact of projects and approaches used in the field of science communication.
Another key component of scientific communication is communication with general public ("general communication"). This mode of communication plays a key role in removing people’s disaffection with science and technology, and promote accountability in research and innovation.

In the last few decades, several approaches have been used (especially one called "Public Understanding of Science" - PUS), which very often entail a sort of a priori diffidence towards the ability of the public to absorb scientific information. As already said, these approaches, despite certain merits and successes, have shown their shortcomings in the face of an increasingly competent and motivated public. For this reason, other approaches have been proposed (such as the "Public Understanding of Research" - PUR, or the "Public Understanding of Current Research" – PUCR, or Public Engagement with Science and Technology - PEST), which aim to involve the public interactively in setting up and managing ongoing scientific research.

However the use of such innovative methods is not always easy and requires commitment and dedicated effort. Other problems include the use of appropriate language, the overdose of information in the media, and especially in the Internet, the capacity to tackle some very controversial and often over-dramatised issues (e.g. biotechnology). This is, therefore, another frame of responsibility, concerning which the following practical options have been identified.

**PRACTICAL OPTIONS**

**P063: Promoting new approaches to scientific communication, besides PUS, among researchers and decision makers**

To promote as means of dissemination of scientific information: seminars and publications, or experimentation based on the principles of "Public Understanding of Research" (PUR) and/or "Public Understanding of Current Research" (PUCR) (see box).
“(...) The challenge to those charged with public science education is to design and implement effective methods of explaining ongoing research to the layperson that will attract and hold their attention and to find channels of communication that are readily accessible to the lay public. Because of the differences in nature between established science and current research, they require different modes of presentation. By focusing on established science, for which the results are demonstrable and the implications for the average citizen clear, a single, inclusive exhibit, film, or other presentation is generally sufficient to convey the information and show applications of the discoveries. It is possible to reconstruct the steps that led to a significant discovery, thereby giving a sense of the process of discovery and underscoring the significance of basic research, which often sets the stage for major breakthroughs. In addition, a presentation can be developed that remains accurate and therefore usable for a relatively long period of time.

By contrast, ongoing research is not static, and new results are constantly changing the course of an investigation. Therefore it is necessary to frequently update the information, making it impossible to provide accurate and complete information in a single presentation.

Rather, a format that allows one to revisit a topic numerous times is essential.

For ongoing research, coverage is likely to include unproductive as well as successful ventures, giving some insight into the process by which the research direction is altered by new data. In addition, one can only speculate on possible applications of the new technology.

Since research is an ongoing process, often lacking definitive answers, it tends to generate controversy. The public needs to understand the positive role of controversy in shaping the research process rather than viewing it as an indication of poor science or befuddled scientists.

Also, a distinction must be made between uncertainty generated as a normal part of the research process and uncertainty as the result of a poorly designed or conducted investigation. This necessitates some public insight into the research process. Laypersons need to understand something, for instance, about what are appropriate and adequate controls and about the process of peer review. Much of current research has raised a number of social, ethical, and policy issues. Issues such as: labelling of genetically modified food, cybercrime and an individual’s right to privacy, environmental legislation, and genetic testing for incurable conditions are highly controversial.

Therefore, it is important to provide a forum for the discussion of these issues in the context of what is known scientifically and what still needs to be determined. (...)

www.iop.org/Journals/PUS
“(...) The idea of science communication as a transfer from someone who knows to someone who does not know (an idea that pervaded the experience of the Public Understanding of Science) is being replaced by more and more complex models of science communication. Those who operate in museums and science centres are paying more attention to the search for methods that are not “top-down”, but which create a dialogue of communication, whether it is a question of planning events and workshops or of setting up new exhibitions. At the same time they are looking for a way of proposing to the public not only established, standard science (as occurs in hands-on museums of the traditional type, where, for example, phenomena with an optic or mechanical base are shown, etc.), but also science in the making, the research that is being done today in laboratories all over the world.

This means on the one hand showing science in its methods of production rather than in its final results, and on the other presenting also its most controversial themes, the most uncertain results that are also being discussed in the scientific community. As a guarantee of the vitality of the museum and the quality of its contents, the nearness to research centres is a decisive factor from the point of view of the Public Understanding of Current Research. (...)”


PO64: Promoting initiatives for the dissemination of science, or extending initiatives already under way

New approaches to scientific communication (see above) should not altogether supplant other means of informing the general public and raising awareness as practiced in various countries. These include: science cities, interactive museums, workshops and competitions for young people, etc. (See box below).

THE CALCUTTA CITY OF SCIENCE

Practices

The Calcutta City of Science was created to encourage the involvement of large segments of the population in the understanding of science and technology, and to raise public awareness of ST applications (in industry, human welfare and the environment). The initiative is sponsored by the National Council of Science Museums, based in Calcutta, which coordinates 26 science museums and science centres across India. The City of Science has a Science Centre (with science parks, shows and attractions of various kinds) and a Convention Centre (with facilities for conferences and seminars).

It promotes exhibitions, seminars, popular lectures, science camps and other programmes both inside and outside the centre (including rural areas). It also organises a number of initiatives in support of institutions, such as schools and universities, technical institutions, colleges and museums, in the creation of science museums and the training of staff.

In one year, the City of Science organises more than 1,000 exhibits on science and technology in India and attracts about 500,000 visitors. Based on the experience and popularity of the City of Science, other similar projects, of different dimension, are being developed across the country.

Patairiya 2002; www.sciencecitykolkata.org.in
**CHILDREN’S SCIENCE CONGRESS**

**Practices**

Since 1993, the Indian National Council for Science and Technology Communication (NCSTC) has promoted each year the Children's Science Congress. The initiative aims at expanding the science education of school children between 10 and 17, involving them in open workshops and practical learning, in the context of a large-scale national event. The initiative has become an important fixture in the national scientific communication calendar, with the participation of at least 100,000 children every year. In this context, conferences are organised in individual states devoted to specific topics, in which participants are selected for the national initiative.

Patairiya 2002; Mazzonetto 2005

**PO65: Developing working tools and promoting meetings for science journalists**

It is particularly important to promote, with the consent and involvement of the editorial staff of newspapers, meetings between journalists and others parties involved in scientific research. For example, in Kenya the Media Association for Environment, Science, Health and Agriculture (MESHA) implements “interactive and holistic” programmes to promote science communication, with the involvement of journalists, researchers and other civil society stakeholders (http://www.meshanet.org/about.html#). In this context, it is important to develop some working tools (e.g. manuals for science journalists - see below).

**PO66: Promoting awareness of STR in schools**

To combat disaffection towards science and technology, initiatives should be taken to raise awareness in schools. These can include meetings, small conferences or even guided visits to museums and institutions (trialed in India and Kenya) to inform young people about STR issues, opportunities, and its many aspects (links between science and development, employment opportunities, the use of technology to solve practical problems, etc). In the case of Egerton University in Kenya, some awareness-raising initiatives in schools were set up specifically to promote science education for girls, who can often be discouraged to undertake or continue studies in this field. Interesting Indian related examples are KSSP activities in schools with low-cost labs and science fairs for children (www.kssp.in/) or Arvind Gupta’s work in communicating scientific concepts to children using local materials and resources (www.arvindgupta.com).
FRAME OF RESPONSIBILITY 16

RESEARCHERS’ ATTITUDE TO SCIENTIFIC COMMUNICATION

▪  RATIONALE

One issue revealed by SET-DEV is the difficulty researchers find in spread information about the results of their research among colleagues a wider audience alike. In the latter case some commentators describe the situation as a "cultural divide" between scientists and journalists.

There are different factors underlying these difficulties: lack of a communicative attitude, due to existing cultural and professional stereotypes; a misguided sense of superiority on the part of academics towards lesser-educated people; shortage of opportunities to meet with communication professionals; lack of technical ability to communicate and package communication products for different targets.

As a result large sections of the population are deprived of the opportunity to receive adequate information on science and technology issues that somehow affect them. This, therefore, is an important, albeit often overlooked, frame of responsibility, which SET-DEV studied on the basis of concrete experiences within partner countries. The following practical options have been identified.

▪  PRACTICAL OPTIONS

PO67:  Raising awareness and training researchers to package findings

Researchers should be encouraged to improve the quality of the packaging of their findings, taking into account different target audiences. This may be achieved with the help of communication specialists (for example, to manage the structure and length of texts, the type of language appropriate for target audience, etc). Such cooperation works even better if conducted in the framework of concrete projects and experiences (e.g. in agricultural projects, the development of appropriate technologies in the field of sanitation, etc). Particularly active in this area is the aforementioned Media for Environment, Science, Health and Agriculture in Kenya (MESHA).

PO68:  Creating places and occasions for researchers and journalists to meet

It is important to create places and opportunities for exchange of opinions between researchers and the media. For example, based on SET-DEV experiences, one particularly suitable instrument is a joint seminar, in which researchers and journalists can openly talk about the obstacles that hinder dialogue and seek common solutions to improve science and technology reporting. In some cases, these seminars can lead to tangible outputs such as communication manuals (see box).
ATPS: strengthening STR reporting

Practices

In August 2010 the African Technology Policy Studies Network (ATPS) in collaboration with Science Africa Ltd. hosted a sensitization workshop aimed at strengthening the capacities of Africa’s science journalists to report more effectively on the centrality of science technology and innovation (STI) in addressing global challenges such as climate change. The workshop attracted 30 new and experienced print, radio and television journalists drawn from 14 ATPS member countries including Burkina Faso, Lesotho, Côte d’Ivoire, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, South Africa, Tanzania, Uganda and Zambia.

African scientists are often recognised and celebrated more in the North than they are at home and this has contributed to the low public perception of science, technology and innovation in Africa. Development issues such as poverty eradication; as well as emerging technologies with the potential of improving the livelihood of Africans always go under reported in many African media outlets, which tend to favour reports on conflicts, crisis and emergencies because of the perception that they sell more. As a result, a gap has been left between innovation and its potential to eradicate poverty in Africa, despite the continuous evolution and development of scientific research. The workshop therefore highlighted the vital role that the media needs to play in the dissemination of new and emerging technologies by highlighting the impact of such technologies on people’s lives.


Joint seminars for journalists and researchers in India

Practices

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) adopts in India an innovative approach to dialogue and exchange between actors from different disciplines and operational sectors, for example, by promoting meetings and seminars involving the joint participation of researchers and journalists, or researchers and NGOs. It has also published documents and manuals on these experiences.

www.icrisat.org/Publications

PO69: Disseminating new communication methods to involve different actors in the debate on STR

Employment of new methods of scientific communication developed in different parts of the world that can be fine-tuned, adapted and disseminated in accordance with different local contexts. Some examples are the "science cafés" in Africa (see box) and write-shops, which are intensive workshops on the writing of information. These methods typically involve actors firm different professional backgrounds and intense interaction.
African Science Café

Practices

Based on experiences in other African countries, the British Council and the British communication and training firm “The Creative Collective” organised a series of dissemination and discussion meetings in Kenya based on the “science café” model. This model involves setting up a speaker led discussion group in a relaxed, informal and flexible environment, like a restaurant or a café. Participants discuss science and technology and its impact on everyday life.

Among the topics discussed in science cafés organised in Kenya, the AIDS Vaccine Initiative, in particular, aroused lively debate.

Science cafés in Kenya have attracted not only participation from the public but also the mass media and television. The public attending the cafés is extremely varied: from journalists to students and young people, which thus enter into effective communication with scientists. To facilitate replication (in Kenya and elsewhere) “The Creative Collective” has produced – for the British Council - a toolkit to facilitate the opening of science cafés in Africa.

www.britishcouncil.org/africa-african-science-cafes.htm
Despite the growing recognition of the importance of science communication in strengthening ties between STR and society, current modes of communication still often lack relevance and accessibility keeping large segments of the population on the margins of scientific communication.

Information was collected during SET-DEV on various difficulties and obstacles in this area, including communication that does not take into account differences that may exist between target audiences; use of approaches imitating Western-style reporting; use of one-way modes of communication that do not allow for feedback; lack of respect for cultural diversity; indiscriminate use of technical language; little consideration for local languages.

Faced with these difficulties and obstacles, new and more appropriate forms of scientific communication are being experimented with, often with success, which try to transmit information to specific social groups, and in some cases even actively involve these groups in the production of information. The following practical options have been identified in this regard.

### Practical Options

**PO70: Promoting the study and implementation of scientific communication models relevant to different local cultures**

It is important to promote activities to study and develop scientific communication models targeting specific national and local communities. There are some particularly interesting research projects such as NISTADS in India, where new tools and languages have been trialled (see box).

**The use of media “culturally” closer to the people**

Practices

A survey conducted in India by NISTADS shows the scale of "cultural distance" of the population from the contents of certain disciplines. The best understood are agriculture, health and hygiene, while the most distant are astronomy, cosmology, geography and climatology. More effective communication for the latter disciplines can be achieved by instruments linked to local communication traditions or everyday communicative customs (e.g. television serials, street theatre, puppet shows, etc).

Raza et al. 1996
**PO71: Organising scientific communication initiatives aimed at reaching specific target populations**

It is important to promote scientific communication projects and initiatives that take into account the diversity and on some occasions a highly stratified nature of the recipients of information. These can be, for example, inhabitants of villages, students, women, specific underprivileged or marginalised groups, etc. Egerton University in Nakuru (Kenya), for example, uses a mix of awareness-raising activities, ranging from publications in local media to the involvement of civic leaders as active communicators in their communities.

---

**KENYA: COMMUNICATION AND TECHNOLOGY IN COSMOPOLITAN CITIES**

**Practices**

“Nakuru is a cosmopolitan town where we have a diverse community from different cultures and hence different attitudes towards sanitation. For instance the use of ashes in UDT toilets is not acceptable to some community who believe the ashes will cause their pregnant women to have miscarriages. So to dispel such myths requires education and training. Also in the case of the Muslim community, we have installed washers in the toilets. We engage the media a lot where queries are addressed. We also supply calendars that have useful information on each page. We also engage the civic leaders who are really key in influencing public opinion.”

Extract from an interview with Benedict M. Mutua - Dean Faculty of Engineering and Technology, Egerton University (October 19, 2009)

**PO72: Using national and local languages for scientific communication**

Where possible communication materials should be created in local languages, for example, in languages such as Telugu in Andhra Pradesh or Kiswahili in Kenya. Thus, not only can the results of modern scientific research be made accessible to vast strata of population, but also a dialogue between science and traditional knowledge can be established (see box).
“(…) This marginalisation of African languages and practices means much local knowledge is lost. Many innovations by farmers and rural communities are excluded from modern science and technology (S&T) because there are no local terms or expressions to capture them.

It is vital for ordinary people to be able to participate in science innovation. Moving the large body of indigenous knowledge into mainstream S&T systems will help address pressing development issues on the continent.

Engaging ordinary people with S&T could also help prevent unfair exploitation of natural resources and make citizens more aware of laws protecting these resources at national and regional levels.

African policymakers must make an effort to 'domesticate' science by using vernacular languages to talk about it. This means investing in translation activities.

Literal translation is, of course, an important aspect. Initiatives to compile science dictionaries are a welcome step forward. Zimbabwean scientist Christopher Chetsanga is, for example, compiling a dictionary in the Shona language — spoken by nine million people in Zimbabwe — that should do much to improve local understanding of scientific terms and issues (…)”.


**P073: Identifying and spreading good science communication practices**

It is particularly important to promote projects, either national or transnational, aimed at identifying and spreading good practices in the field of science communication. In fact, there are numerous examples all over the world of efforts being made to improve the relevance and accessibility of such communication, which, however, often do not cross local boundaries and remains confined to specialised literature. In this regard, tools that can be used include the publication of books, special issues of magazines, organisation of seminars, creation of thematic networks and discussion groups, and creation of portals and web sites or parts of existing web sites and portals.

**Some aspects of scientific communication in India**

National Institute of Science Technology and Development Studies (NISTADS) in 1989 organised the first large scale national survey on public understanding of science. In India context, the John Miller’s model of scientific communication is seen to be inappropriate. A cultural model which believes that one has to look at the culture of the people to know their knowledge was adopted as the framework for the survey. In this cultural model, there are demographic determinants which affect the cultural and cognitive structures.

***

Some institutions which are functioning in the area of S & T communication in India are the following ones.
National Institute of Science, Technology and Development Studies (NISTADS), New Delhi is devoted to study of various aspects of interaction among science, society and state and exploring continuously the Interface Between Science Technology and Society (see above). NISTADS is one of the 42 institutes/laboratories of the Council of Scientific and Industrial Research (CSIR), New Delhi.

National Council of Science and Technology Communication (NCSTC) is an institution established by the DST devoted to popularise science.

Vigyan Prasar, (VP) is an autonomous organisation under Department of Science and Technology. Objectives of VP are to take up large-scale science popularization tasks/activities, to promote and propagate scientific and rational outlook, to act as a resource-cum-facility centre for S&T communication. VP was established in 1989. It has the following objectives:

- To promote and propagate scientific and rational outlook.
- To act as a resource-cum-facility centre for S&T communication.
- To take up large-scale science popularisation tasks/activities.
- To develop, disseminate and market a variety of software on S&T popularisation in different Indian languages (Audio, Video, Radio, TV, Print, Learning packages, Kits, Toys).
- Using different media for S&T Communication.
- Use of new/emerging technologies for S&T Communication.

The Centre for Science and Environment (CSE) is a public interest research and advocacy organisation based in New Delhi. CSE researches into, lobbies for and communicates the urgency of development that is both sustainable and equitable. The scenario today demands using knowledge to bring about change.

The Centre for Science and Environment (CSE)'s publications and informational products have been its strength and they have always combined research and readability to get the message across. CSE’s tools for awareness raising are periodicals, publications, films/short spots, briefing papers, exhibitions, posters and other products. CSE’s informational products reach people in more diverse ways such as features service, website and e-news bulletins. CSE’s efforts are specifically designed to create awareness about problems and propose sustainable solutions. Research at CSE often consists of in-depth learning about an environmental problem and then finding answers in accordance with CSE’s core values.

Science for Equity, Empowerment and Development (SEED) Division has been set up under the Department of Science and Technology, established with the broad objectives of providing opportunities to motivated scientists and field level workers to take up action oriented and location specific projects aiming towards socio-economic upliftment of poor and disadvantaged sections of the society through appropriate technological interventions especially in the rural areas. Under this program efforts have been made to associate concerned National Labs or other specialist S&T institutions with each major program so as to build-in expert input, utilize national S&T infrastructure and link it up with grassroots S&T interventions/initiatives.

The Indian Science Congress Association (ISCA) established in the year 1914 and owes its origin to the foresight and initiative of two British Chemists, namely, Professor J. L. Simonsen and Professor P.S. MacMahon. It occurred to them that scientific research in India might be stimulated if an annual meeting of research workers somewhat on the lines of the British Association for the Advancement of Science could be arranged.
**Networking of Social Scientists** - National Centre for Agricultural Economics and Policy Research (NCAP) was established by Indian Council of Agricultural Research (ICAR) in March 1991 to strengthen Agricultural Economics Research in National Agricultural Research System (NARS) comprising ICAR organisations and state Agricultural Universities (SAU’s).

Scientific institutions in India have so far focused their efforts on creating infrastructure for cutting edge research in the area of life sciences. Institute of Genomics and Integrative Biology (IGIB), in collaboration with Institute of Molecular Medicine (IMM-The Chatterjee Group) for the first time, has looked at opportunities in core - shared research facility by leveraging their domain specialisation and accessing competencies to provide high quality platform for scientific research. The Institute initiated an Open Source Drug Discovery (OSDD) to understand the molecular biology of TB to find a cure.

Excerpts from University of Hyderabad SET-DEV working papers
LESSONS LEARNT ON SCIENTIFIC COMMUNICATION

LESSONS LEARNT ON SCIENTIFIC COMMUNICATION: KENYA

- A multi-disciplinary approach to scientific communication is essential
  
  There is a need for STR bodies to involve actors from different relevant disciplines, such as sociologists, anthropologists, and development and communication specialists, in scientific communication.

- For effective communication, there is a need to build reciprocal skills of scientists and non-scientists
  
  It is evident that scientific communication via the mass media often fails to make impression on the public mainly for two linked reasons: on the one hand, scientists are often not effective in using a language that is easily appreciated or understood by non-scientists and, on the other hand, not enough scientists take to journalism. So researchers in STR institutions would benefit from seminars and workshops on effective communication - and media houses would benefit from engaging more scientists in addressing scientific topics.

- For scientific communication to be effective, a focus on issues relevant to people’s lives is required
  
  In writing for, and/or communicating with, the general public or specific target groups within the larger population on outputs and findings of STR, it is important that those who wish to encourage the take-up of technological innovations focus on issues and examples that are of direct relevance to those who are being addressed.

- There is scope for applying innovative and interactive approaches to scientific communication
  
  The potential for applying innovative and interactive approaches to scientific communication and information dissemination, such as local FM radio, community theatre, and other folk art methods, can be more fully explored.

LESSONS LEARNT ON SCIENTIFIC COMMUNICATION: INDIA

- There is a need to enhance and democratise the public debate on science and technology.

- There is also a gap in recognising civil society experiences in the field of S&T. There is a need for communication on the part of the academia and policy makers to interact with CSOs.

- There is a need to involve CSOs as partners in knowledge production by the academics state and industry.

- Through the interactions at the project SET DEV workshops it was observed that there is a need to organise seminars and informal sharing sessions with researchers, decision-makers, journalists, civil society representatives and other stakeholders on the state of the art in key research areas and the exploitation of research findings to the benefit of the community.

- Improving and promoting initiatives to sensitise young minds on issues relating to the Science and technological responsibility at the school level and college levels are needed.
Also needed is a programme to **improve practices regarding science communication among scientists** and at under graduate and graduate levels.

There is a need to **propagate working tools and meetings for science journalists** in national and local newspapers as well as magazines which carry science research articles.

In India science is still secretive and work carried out in the laboratories is not known to public in general. There is a **need for co-ordinating work in the area of patent protection** as some discoveries in the institutions remain unpublished. Scientists are secretive towards announcing about the research they conduct. In other words there is absence or limited communication of science.

*For further information, see also:*

- Area 1: frame of responsibility 1
- Area 2: frame of responsibility 6
- Area 4: frames of responsibility 18, 19
- Area 5: frames of responsibility 23, 27
- Area 6: frames of responsibility 31, 32, 33
- Area 7: frames of responsibility 37, 39
- Area 8: frames of responsibility 40, 42
SUMMARY

Area 3 - Scientific Communication

Frame of responsibility 10:
Intra-epistemic communication

Practical Options
PO44: Promoting permanent structures for communication between researchers in the same discipline
PO45: Supporting researchers in publishing their work
PO46: Introducing new web applications and services

Frame of responsibility 11:
Trans-epistemic communication

Practical Options
PO47: Raising awareness among researchers about the importance and benefits of trans-epistemic communication
PO48: Creating common languages and environments to foster dialogue among researchers of different disciplines
PO49: Promoting multidisciplinary publications

Frame of responsibility 12:
Network communication

Practical Options
PO50: Experimenting with new forms of information exchange between researchers, management and administration
PO51: Organising initiatives for interaction and dialogue between science managers and publishing managers
PO52: Strengthening communication with funding institutions

Frame of responsibility 13:
Social communication

Practical Options
PO53: Promoting opportunities for dialogue with stakeholders on the state of the art in key research sectors and the exploitation of research findings for the benefit of the community
PO54: Promoting forms of citizen consultation about priorities, dilemmas, risks and opportunities of technological options
PO55: Experimenting new tools to expand and democratise the debate on science and technology
PO56: Fostering programmes to “return” the results of scientific research to stakeholders
PO57: Promoting the dialogue on STR among local communities
**Frame of responsibility 14:**
Dialogue among decision makers and researchers

**Practical Options**
- PO58: Promoting seminars and other forms of information exchange for policy makers and researchers
- PO59: Sensitising decision makers to the usefulness of research findings
- PO60: Developing mechanisms to present research results to politicians
- PO61: Establishing a national database of active researchers
- PO62: Creating national agencies for the management of scientific communication policies

**Frame of responsibility 15:**
General communication

**Practical Options**
- PO63: Promoting new approaches to scientific communication, besides PUS, among researchers and decision makers
- PO64: Promoting initiatives for the dissemination of science, or extending initiatives already under way
- PO65: Developing working tools and promoting meetings for science journalists
- PO66: Promoting awareness of STR in schools

**Frame of responsibility 16:**
Researchers’ attitude to scientific communication

**Practical Options**
- PO67: Raising awareness and training researchers to package findings
- PO68: Creating places and occasions for researchers and journalists to meet
- PO69: Disseminating new communication methods to involve different actors in the debate on STR

**Frame of responsibility 17:**
Relevance and accessibility of scientific communication

**Practical Options**
- PO70: Promoting the study and implementation of scientific communication models relevant to different local cultures
- PO71: Organising scientific communication initiatives aimed at reaching specific target populations
- PO72: Using national and local languages for scientific communication
- PO73: Identifying and spreading good science communication practices

**Lessons learnt Kenya**
- A multi-disciplinary approach to scientific communication is essential.
For effective communication, there is a need to build reciprocal skills of scientists and non-scientists.

For scientific communication to be effective, a focus on issues relevant to people’s lives is required.

There is scope for applying innovative and interactive approaches to scientific communication.

**Lessons learnt India**

- Enhance and democratise the public debate on science and technology.
- Bridging the gap in recognising civil society experiences in the field of S&T.
- Involve CSOs as partners in knowledge production by the academics state and industry.
- Organise exchanges among researchers, decision-makers, journalists, civil society representatives and other stakeholders on the state of the art in key research areas.
- Improving and promoting initiatives to sensitize young minds on issues relating to the Science and technological responsibility at the school level and college levels.
- Improving practices regarding science communication among scientists and at undergraduate and graduate levels.
- Propagate working tools and meetings for science journalists.
- Co-ordinating work in the area of patent protection.
Demand for science evaluation has been growing at the global level. This is reflected both in a steady although slow increase in practices, policies and measures leading to greater accountability in science as well as in the widening of the scope of evaluation to include such topics as research management, the exploitation of STR outcomes, scientific communication, science and technology policies, science – industry interaction, use of technologies for development, etc. Evaluation assumes an important role as a factor of improving policy design, policy implementation and resource allocation.

Even though evaluation is widely recognised as an important task, many problems still remain unsolved, hindering an effective evaluation process. SET-DEV highlighted some of them, including the insufficient diffusion of research evaluation culture, a gap between research evaluation and the funding process, the emergence of new organisational and professional structures that are often under-formalised and are outside public control, shortage of appropriate evaluation methodologies, the inadequacy of career and publication evaluation systems, the excessive influence of market dynamics and of donors-beneficiaries relationships on setting evaluation criteria. Moreover, the Indian and the African “Manifestos” developed under SET-DEV clearly outlined the inadequacy of evaluation exercises that are not based on broad participation of local actors and are poorly related to local and national contexts (see the box below).

It is evident that relevance, efficacy and transparency of evaluation processes have important consequences, both on the side of research functionality and on the side of its economic and social impacts. Therefore, when evaluation is not seriously taken into account, different types of problems may emerge which make it possible to identify the following frames of responsibility:

- dissemination of evaluation practice;
- quality of evaluation;
- adaptation of evaluation;
- transparency of evaluation;
- quality of evaluators.
The African Manifesto for Science, Technology and Innovation points out that:

“(…) It is however the responsibility of Africa and ‘the African’ to shape its own STI agenda, funding strategies, capacity development programs, organisational reforms and develop its own rules for effective but contextualized criteria for monitoring, evaluation and accountability. These tools must be fully embedded in Africa’s societies, cultures and human experiences. (…)”

Among the recommendations, it includes:

“Encourage new forms of STI monitoring and evaluation, and inclusive incentive structures: Develop alternative matrices for the evaluation of STI taking into account international standards as well as local relevance”

The Knowledge Swaraj: An Indian Manifesto on Science and Technology, in turn, connects evaluation issue with that of the plurality of expertise:

“(…) Taking the multifaceted character of modern science and technology seriously makes it inevitable to adopt the previously introduced broad view of expertise. It does not make sense to talk of “scientific expertise” per se, as was already recognized in the debate on specialists and generalists. A nuclear physicist does not have expertise in dam building and vice versa. The dam building engineer is in no better position when discussing a nuclear power station than any other well-informed citizen. The only sensible way to conceptualize expertise is as a spectrum of different forms of expertise. There is no ground for prioritizing the expertise of a certain domain, at least not in a general fashion. For certain questions you need expertise of physics, for others of sociology. For some questions you need expertise that can actively contribute, for other questions the expertise that allows you to interact is sufficient.

For a “scientific audit” or a peer-review assessment of a project you need contributory expertise in that specific domain. For a “social audit” such expertise would not be enough and perhaps not even necessary. For a social audit you need a variety of interactional forms of expertise. Depending on the precise question of the social audit, you will need citizens, stakeholders, scientists, and/or engineers. And, of course, not any citizens, stakeholders, scientists, engineers; but those with the specifically required interactional expertise for that particular social audit.

From all experts we expect a form of critical self-reflection, knowing where the limits of their forms of expertise are and where and when to involve other experts.” (…)
Despite the fact that evaluation is increasingly recognised as a cornerstone of STR, in many areas of research and decision-making this recognition has not yet translated in practical deeds.

SET-DEV has found no widespread culture of research evaluation either India or Kenya; in fact it can be said that there is often a cultural resistance to evaluation, which prevents this activity from becoming widespread. The common problems are imbalances in evaluation practices when evaluation of certain projects takes place at the expense of some other projects or activities; lack of awareness among researchers of the importance of evaluation; lack of awareness among decision-makers of the link between evaluation and policy-making; lack of support programmes for evaluation; lack of up-to-date information on evaluation methods. Another common problem in STR evaluation is the lack of adequate resources for facilities, personnel, and upgrading knowledge and skills.

These difficulties present as a whole a serious limitation for national research systems, and could produce considerable negative impact on research quality and allocation of funds. Because of these problems, the dissemination of evaluation practices is an important frame of responsibility, for which some practical options can be identified.

**PRACTICAL OPTIONS**

**PO74: Promoting the monitoring and evaluation of research plans and projects at any level**

Top-level decision-makers and scientific authorities should promote as much as possible the evaluation of research programmes and projects (see box below). The promotion of evaluation should involve all levels (from national authorities to single institutes), and cover every phase of planning: before implementation, during implementation (through monitoring) and after the formal conclusion of the plan or project. To promote and disseminate evaluation, the following actions can be undertaken: participation of national and local actors in international and regional associations, networks and projects for the evaluation of S & T or specific operations.
In India, several governmental and national public research and assessment bodies play an important role in setting up and promoting assessment of scientific and technological research. These include, for instance:

- the Council for Scientific and Industrial Research (CSIR), especially one of its institutes, the National Institute of Science, Technology & Development Studies (NISTADS), which measures ST progress in India and promotes specific programmes dedicated to the complex issues of research assessment;

- the National Assessment and Accreditation Council (NAAC), which task is to assess and accredit higher education institutions throughout the country (see below);

- the Technology Information, Forecasting and Assessment Council (TIFAC) which is engaged in technology assessment and forecasting studies for certain sectors of the national economy; it also monitors global trends to formulate the best options for India;

- the Indian Academy of Social Sciences (ISSA), which carries out research and teaching assessment activities in the field of social sciences in India;

- Department of Science & Technology (DST), Ministry of Science & Technology, which has programmes for STR assessment, through surveys;

- The Department of Scientific and Industrial Research, Govt. of India, which has assessment programmes and awards at the national level in the field of R&D;

- The Department of Biotechnology (DBT), Ministry of Science and Technology, which has an extensive programme of assessment and awards, including young scientists and researchers.

From the final report of work package 1 - “Preparation and start-up of the activities of networking and information gathering” (SET-DEV), 2009

As regards Kenya, the following bodies promote scientific evaluation:

- National Council of Science and Technology (NCST), which assesses STR status and policies, as well as research projects funded by this organisation;

- Kenya Institute for Public Policy Research and Analysis (KIPPPRA), which assesses public policies involving S&T aspects;

- Kenya Agricultural Research Institute (KARI), which carries out different types of evaluation, with regards to technology transfer programmes;

- Kenya Bureau of Standards (KEBS), which carries out evaluation services at different levels (food quality, environment, etc.), sets standard, and publicise metrology;

- Kenya National Academy of Sciences having a role in assessing the Kenyan research system.

From the final report of work package 1 - “Preparation and start-up of the activities of networking and information gathering” (SET-DEV), 2009
PO75:  **Raising the awareness of researcher of the best practice of evaluation**

To raise awareness among researchers of the importance of evaluation, appropriate initiatives should be undertaken within individual institutions or networks of institutions. This usually involves organising seminars and training courses, meetings for groups of researchers interested in promoting evaluation, or informal meetings.

PO76:  **Foster decision-makers to allocate adequate funding for STR evaluation**

It is important for decision-makers to promote initiatives that ensure an adequate flow of resources specifically for evaluation. In the study conducted by SET-DEV, some initiatives were found particularly useful, for example, seminars and roundtables that bring together researchers and decision makers. Meetings of this type provide a favourable opportunity to discuss important practical aspects of evaluation such as the role of evaluation in STR policy-making; the availability of staff needed for evaluation, at both central and local levels; financial and structural resources necessary for evaluation; evaluation training courses for both decision-makers and researchers; discussions of successful international experiences in the field of evaluation for policy-making.

PO77:  **Implementing programmes to support continuous assessment**

It is of strategic importance to promote different forms of continuous assessment for research, both centrally and in individual research institutes. To this end, centralised and decentralised coordination structures need to be set up or strengthened, for the purposes of promotion, methodological and technical development, and monitoring of evaluation activities at various levels. Also, programmes on specific aspects of evaluation can be promoted, such as capacity building, the evaluation of the impact of STR policies, etc. Special attention to this need was given, for example, by the National Assessment and Accreditation Council for quality university education in India, which launched some programmes to support the spread of continuous assessment within institutions, promoting specific internal quality assurance cells (for details, see below).
The quality of evaluation is crucial because of its impact on the socialisation of STR. Evaluation must meet the criteria of relevance and importance (see below), be based on appropriate approaches and methods to meet set targets and should preferably be shared by all actors involved in this type of activity (decision makers, evaluators, researchers, stakeholders, etc).

Many different problems and obstacles of varying degrees of importance were identified during SET-DEV activities: fragmentation, which occurs when assessment usually focuses on small and specific issues; difficulty of developing and fine-tuning appropriate evaluation methodologies; lack of accountability as evaluation activities are usually carried out “in-house” rather than by external evaluators; the excessive influence of market mechanisms and of donors-beneficiary relationships in setting evaluation criteria; lack of evaluation of STR policies, although these policies have been in place for several years; evaluations carried out by local experts whose opinion has low prestige because of belief these evaluations depend more on personal relationships than merit; reliance on evaluation criteria developed abroad; tendency to assess local researchers on the basis of funds secured from foreign donors, and so, by extension, to assess research in accordance with priorities and criteria employed abroad; imbalance in quantitative (predominant) and qualitative evaluation criteria; incompleteness of scientometric evaluations, which are mainly based on international journals, taking little account of domestic production in countries; “egalitarian” distribution of awards for successful research, without recognising the role and the work of individuals and groups (for instance awards are given to entire departments, rather than to specific groups).

At the same time, new attitudes and practices are becoming widespread, such as the proliferation of manuals and guidelines, the increasing presence of government and non-government organisations responsible for tracking and monitoring research and technology, the presence of new practices to assess development projects and technology transfer, which could be used as important reference points.

The quality of evaluation, therefore, is to all intents and purposes an important frame of responsibility. In this respect, the following practical options can be identified.
**PRACTICAL OPTIONS**

**PO78: Application of updated methods of evaluation**

A support service should be provided to guarantee updated methods of evaluation for national and local projects (see box). Government and scientific organisations in charge of coordinating STR policies should be involved in promoting national information campaigns and refresher programmes, using tools such as web sites, seminars, publications, and more.

**SOME APPROACHES TO STR EVALUATION**

There are several approaches to the evaluation of scientific and technological research. Some are better known and more often used than others. One way to classify them is to group them into qualitative, quantitative and mixed.

Qualitative assessment approaches involve different specialised actors in, for example, peer reviews, capacity evaluation, activity evaluation, historical evaluation (long term). Quantitative approaches are based on defining and comparing indicators, and include, for example: scientometric/bibliometric analysis, webometric analysis, input analysis, quality analysis, innovation surveys, benchmarking, prospective studies, cost-benefit and cost-effectiveness analysis, network analysis.

Mixed approaches include, for example, impact assessments and user evaluation.

Currently, throughout the world, assessment is being viewed from new perspectives, which could lead to the development of other approaches and methods. These new perspectives concern, firstly, the importance of the social dimension of research, namely: taking into account the characteristics of research actors, taking into account the social and cultural barriers that affect the performance of research institutions, reviewing "classic" evaluation criteria in the light of science’s social dynamics. Another perspective involves enlarging the field of evaluation analysis to all activities that revolve around research (e.g. mediation - see Area 2). A third perspective involves evaluating not only the economic but also the social impact of research (e.g. effects on poverty).

| d’Andrea, Quaranta, Quinti 2005 |

**PO79: Production of evaluation manuals and guidelines**

The production and dissemination of manuals and guidelines could be a particularly useful tool to provide researchers with up-to-date assessment methodologies and techniques. Examples in Europe include the SS-ERC Project Handbook (Bijker, d’Andrea 2009) and the "Manual on STR socialisation processes" (D’Andrea, Quaranta, Quinti 2005), which contain a section on scientific evaluation. Other more specific and targeted examples are the UNDP and UNFCCC Handbook for Conducting Technology Needs Assessment for Climate Change, (http://unfccc.int/ttclear/pdf/TNAHandbook_9-15-2009.pdf), and the National Guidelines for Accreditation, Supervision & Regulation of ART Clinics in India, produced
by the Indian Council of Medical Research (ICMR) (http://icmr.nic.in/art/Prilim_Pages.pdf).11

**PO80: Developing shared evaluation criteria for STR policies**

To avoid perilous misunderstandings, it is essential to produce a clear and generally accepted definition of evaluation criteria for STR policies, as regards such categories as relevance, application and effectiveness, impacts, timelines and evaluation methods. This can be done through consultation spread headed by government institutions at central and local levels, together with representatives of the scientific community and other stakeholders (depending on the problems or aspects to be considered, these could include businesses, civil society organisations, etc). As experience in Europe shows, it is also important to develop tools for dialogue to help decision-makers understand assessment processes (see Bijker, d’Andrea, 2009).

**PO81: Harmonisation of different evaluation methods**

The harmonisation of different evaluation methods is particularly important. For example, the European Commission has set out precise criteria for evaluating fundable projects, which have now become part of the policy cycle. In any event harmonisation does not mean eliminating the diversity of available methods, but rather the objective is to identify for each aim, field of application and context such methods that are most suitable for the purpose. For example, depending on the situation, the Kenya Bureau of Standards uses such divers criteria as accreditation by international scientific associations, local credentials, reference to foreign standards.

**PO82: Application of new accreditation methods towards research entities**

A critical aspect of assessing quality is the adoption of new methods of accreditation of universities and research centres. These methods can take into account a wide range of aspects, from academic quality to scientific production and territorial relations, as currently being experimented in India (see box).

---

11 The Guidelines have given rise, however, to a heated debate. In fact, in addition to its undoubted value in terms of regulation and evaluation, doubts have been expressed, for example, on its "conventional" approach to medicine, in which the patient is still seen as a passive receptor of treatment.
ACCREDITATION OF HIGHER EDUCATION INSTITUTIONS IN INDIA

Practices

The task of the National Assessment and Accreditation Council (NAAC), is to assess and accredit higher education institutions throughout the country and to make quality a structuring element of higher education in India. Its activities include: periodic assessments and accreditation of institutions or specific programmes; support for the promotion of academic quality; promotion of self-assessment, accountability, autonomy and innovation in higher education; promotion of research, consultancy and training programmes on quality. The NAAC has identified the following 7 basic criteria for the assessment of institutions: Curricular aspects; Teaching-learning and evaluation; Research consultancy and extension; Infrastructure and learning resources; Student support and progression; Governance and leadership; Innovative practices.

http://www.naac.gov.in

P083: Support of activities to promote post-accreditation quality

In addition to creating structures for the accreditation of educational and scientific research institutions, it is important to ensure long-term monitoring. Therefore, it is necessary to identify the most appropriate ways of promoting research quality in the post-accreditation period, which can include – as, for example, in India – participatory and voluntary approaches (see box).

POST-ACREDITATION QUALITY SUPPORT IN UNIVERSITIES - INDIA

Practices

In implementing its National Action Plan, the National Assessment and Accreditation Council (NAAC) has determined that each accredited institution should have an Internal Quality Assurance Cell (IQAC) as a way of supporting post-accreditation quality. The IQAC aims to develop an assessment system that can catalyze improvements in the administrative and academic quality of institutions. The aim is to use the IQACs to institutionalize and internalize action to improve quality, calling on the stakeholders’ sense of belonging and participation.

The IQAC is not a new hierarchical control body, but rather a facilitative, participatory and voluntary structure for institutions. To facilitate the implementation of IQACs, the NAAC has circulated special guidelines. After establishing IQACs, 140 accredited institutions have sent reports on the activities of their cells, 40 of these were selected and included in a publication devoted to a collection of good practices.

http://www.naac.gov.in/
The National Assessment and Accreditation Council has developed guidelines for the collection and benchmarking of good practices at the university level, as a means of assessing universities and promoting teaching quality. The NAAC regards good practices as a sign of "institutional quality" that goes beyond the usual performance indicators and also takes into account the processes by which results are achieved. The NAAC’s goal is to understand what leads to success and to bridge the gap between common practices and those adopted in the most advanced institutions. In its guidelines, the NAAC applies an approach called the "Four Is and D model", which includes the following steps: identification, implementation, institutionalization, internalization and dissemination of good practices. Assessments, and any subsequent accreditation, of academic institutions in India take place in reference to a set of parameters used to compare different institutions (e.g. curricular aspects, student progress support, research assessment, etc). One of these parameters concerns the adoption of innovative practices within the institution.

http://www.naac.gov.in/
FRAME OF RESPONSIBILITY 20

ADAPTATION OF EVALUATION

- **RATIONALE**

Greater STR involvement in different social and cultural contexts also requires a process of *gradual "adaptation" of the evaluation procedures* to these contexts and to the needs of the actors concerned. This is especially important when it comes to examining the relevance and impact of specific technologies, or the outcome of certain local development projects that may have serious negative impacts in the absence of a proper evaluation.

This adaptation is **not a simple** process. Standardised approaches to evaluation still prevail. Often they are developed in contexts other than those in which they are applied. Frequently they are implemented without adequate involvement of local social and economic actors. As a result, local forms of knowledge and local priorities do not receive attention they deserve. Moreover, SET-DEV research has revealed instances of incomplete risk assessment for certain technologies (e.g. in health or GM foods). Despite some existing problems, SET-DEV identified numerous examples of greater stakeholder participation in evaluation procedures, as well as growing demand for the measurement and evaluation of specific activities directly or indirectly linked to science and technology.

Thus, the **adaptation of evaluation** can be seen as a specific frame of responsibility, to which different **practical options** can be applied.

- **PRACTICAL OPTIONS**

**P085: Involving stakeholders in evaluation**

It is important to involve stakeholders as much as possible in the evaluation of local development projects or of the application of specific technologies in specific contexts. This involvement helps to avoid unnecessary bureaucratisation and centralisation and to accommodate existing local needs and knowledge. This can be facilitated by the use of participatory evaluation methods that are currently being employed in many research contexts (see box).
PARTICIPATORY APPROACHES IN EVALUATION - KENYA

Practices

In Kenya, the IntermediaNCG has specialised in utilising participatory approaches that involve beneficiaries in reflecting on and analysing the impact of interventions. Recently, IntermediaNCG has produced, on behalf of the Ford Foundation, a Catalogue of Alternative Approaches in Monitoring and Evaluation, which includes those allowing to assess process as well as products and to measure impacts in terms of social change.

P086: Developing and spreading contextualised evaluation methods

It is essential to encourage the development and dissemination of contextualised evaluation methods in the field of STR that take into account the views of local stakeholders on what parameters should be used as evaluation criteria. Since there is little practical experience of contextualisation, it would be appropriate to start by fine-tuning and promoting the concept first, for example, via manuals and catalogues. In this regard, Merkx et al (2007) suggested taking into consideration the “context-dependent” nature of research evaluation, which is linked to different portfolios of objectives and activities. Hence the proposal for a project, currently underway, of creating a sort of “Wikipedia” of contextual evaluation of research, containing information on various existing methods in this respect.

PO87: Developing ad hoc evaluation tools

The contextualisation of STR assessment may also involve efforts to develop ad hoc evaluation tools, to assess specific types of interventions or problems (such as research management, university–industry relationships, scientific cooperation, and use of technologies for development). An interesting example in this respect is the assessment of horticultural policies in Kenya that involves various stakeholders and employing tools such as surveys, focus groups, seminars and meetings (see box).
Horticulture is a fast growing sector, the third largest source of foreign trade revenue in Kenya. Small landowners are responsible for 50% of export production. Intensive production is, however, leading to greater use of chemicals, which in turn generates an increase in production costs and decreasing productivity, as well as greater health risks for workers. Furthermore, the European Union, the main market for Kenyan exports, has set standards that limit the use of pesticides. Although sustainable solutions to protect crops from parasites have been developed in the past through ICIPE (International Centre of Insect Physiology and Ecology) research, they have not been sufficiently considered by policy makers. Consequently, ICIPE carried out an evaluative study on the economic and social impact of a new sustainable approach for the development of horticulture, in conjunction with the Ministry of Agriculture (MoA).

This study created an information base for the identification and selection of priorities for horticultural research to develop recommendations for policies. Research was conducted through direct contact with farmers and public and private stakeholder networks, using surveys, focus groups, seminars and meetings. The types of evaluation used in this project can effectively influence decision making processes, also by virtue of the involvement of the MoA, to create a favourable environment to create links between small farmers and international markets.


**P088: Evaluating the specific impacts of the different technological options**

When developing and applying certain technologies (e.g. for the environment, housing, health, agriculture, etc) a previous assessment should be made of the existing technological options, and their possible impacts in a given social, economic and environmental context. This type of assessment should be promoted with local stakeholders through participatory methods, such as meetings, seminars given by experts, working groups. These solutions emerged from the results of a SET-DEV case study in India, dedicated to post-disaster reconstruction, especially the post tsunami situation in Tamil Nadu.

**P089: Making use of locally available expertise for evaluation**

When evaluating local development and technological innovation projects, it is important to take full advantage of both locally available expertise and “external” expertise. This recommendation is based on the investigation of several SET-DEV case studies in India that focused on identifying problems and solutions regarding the plurality of expertise in the field of technology. This involves, first of all, mapping local researchers (in various disciplines) and other social actors that may be relevant to projects. Secondly, participatory planning and evaluation activities need to be carried out through seminars to fine-tune methods, assessment tests, individual and group interviews, collection of documents and statistics, etc, with the involvement of local actors.
It is clear that a greater degree of transparency is needed to improve and spread evaluation.

The increasingly complex research landscape that features more and more networks and actors, the growing need to link the allocation of funds to evaluation, the emergence of new organisational and professional structures that are often under-formalised and outside public control are some of the factors that push for greater transparency in the evaluation of STR. There is little doubt that lack of transparency in STR assessment may create a serious threat to the credibility of research in the eyes of the community.

In this area there are still many problems and unanswered questions. One problem is the difficulty in determining evaluation standards, and the absence of a reference framework for research evaluation. Another is the paradoxical imbalance with regard to funded sectors. This situation was observed in India: projects in areas where substantial funds are available receive little attention in terms of assessment and control, while where there are relatively few funds (e.g. in agriculture) there is greater evaluation activity. Another problem is the use of evaluation procedures that discourage international scientific collaboration; the existing system of promotions and awards do not encourage scientists to seek international collaboration, which, therefore, remains an elite activity. Finally, there is lack of accountability. Evaluation is often accomplished “in-house” rather than with the assistance of external experts. This discredits evaluation and its results as members of public may have doubts about its objectivity.

It is clear that a greater degree of transparency is needed to improve and spread evaluation. This is an important frame of responsibility, concerning which the following practical options have been identified.

**PO90: Defining public evaluation procedures**

It is essential to promote, at all levels and wherever possible, public evaluation procedures for STR. Based on experiences in Europe, India and Africa, some of which have been mentioned above, this may be done by setting standards, defining regulations, identifying jointly agreed procedures and through broad stakeholder participation.
PO91:  Creating commissions for a “Ethical review” of research procedures

To apply the principle of assessment transparency in everyday scientific research procedures, structures and services can be set up for an “ethical review” of the work of researchers and institute managers. To this end, special offices can be set up, or the responsibilities of existing structures, both at national and local levels, can be expanded (see box).

**ETHICAL REVIEW PROCEDURES**

Practices

In Kenya different types of “ethical reviews” have been developed for evaluation of research procedures, through the work of special committees in various institutes and research departments. An active part in the evaluation process is played by National Council of Science and Technology (NCST). A specific and important area of intervention is that of evaluation malpractices, which can be addressed by setting up special monitoring structures, or employing third-party organisations that are independent of the organisations observed.

SET-DEV – Reports of pilot programmes in India and Kenya 2009-2010
FRAME OF RESPONSIBILITY 22
QUALITY OF EVALUATORS

- RATIONALE

An important frame of responsibility in the evaluation of STR is the quality of evaluators. Notwithstanding the fact that assessment is a process that involves different types of actors, it is advisable to check the professionalism of those directly involved in or responsible for the co-ordination of this process within the research community.

As emerged from studies carried out as part of SET-DEV, this aspect of assessment has many problem areas, such as indiscriminate choice “experts” without proper controlling if they have specific or vested interests in evaluation, particularly as concerns new technology; lack of scientific and/or ethical controls over "experts" in specific research areas, especially as regards the control and distribution of resources; lack of qualified peers and little availability of qualified evaluators for carrying out peer reviews in the evaluation of research laboratories.

An emerging frame or responsibility can therefore be identified as the continuous and public assessment of evaluator quality that results in the following two practical options.

- PRACTICAL OPTIONS

PO92: Ensuring transparency of the decision-making process as regards evaluation

Since responsibility for evaluation (for example, of the desirability of certain technological solutions) is given to "experts" that do not belong to research networks and organisations, it is important to ensure, in this as in other cases, that the evaluation and the criteria on which the evaluation is based receive the greatest degree of transparency and publicity (see box). To this end, the evaluation criteria used should be published, or supervisory committees or groups set up. The panel of experts with names, expertises and their contribution to any evaluation, should also be made public.
ROLE OF THE “EXPERTS” AND THE NEED FOR TRANSPARENCY

“(….) society relies increasingly on science and technology. Every new technology has associated with it a complex chain of both intended and unintended consequences. The social value of these technologies, often driven by big business unconcerned with their longer-term consequences, is typically assessed in a scientifically illiterate society by “experts” who may be neither knowledgeable nor honest. Something must be done to ensure at least the latter, possibly by setting up fora to document and monitor ethical norms in scientific research and management. There are precious few such in India, and those that there are, function in a non-transparent way and involve persons with dubious backgrounds who might merely be acting as “fixers”. Given the difficulty of proving ethical violations, this situation provides a free hand for social exploitation of the sort which is disadvantageous to people at large, and puts future generations to serious risk (…)”.

From the Draft Note, National Symposium on the Ethics of science, Indian Academy of Social Sciences, Delhi, 19-21 December 2008

PO93: Implementing programmes to identify and select qualified peers as evaluators

Since qualified peers are not always available for evaluation, in some cases it is advisable to set up specific programmes to identify and select these peers. This can be done by means of mapping, ad hoc surveys, collecting information from research groups and networks, selection interviews and meetings, and distance selection (for example, by reviewing publications and other research work). This can promote a process to identify personnel that can ensure adequate evaluation quality, and, at the same time, create or consolidate research assessment networks.
LESSONS LEARNT ON EVALUATION

LESSONS LEARNT ON EVALUATION: KENYA

- Innovative and participatory approaches towards evaluation and impact assessment are needed

Adopting innovative and participatory approaches towards evaluation and impact assessment that involve the beneficiaries of STI can be beneficial in a number of ways such as gaining a common body of knowledge or shared information base from which responsive policy recommendations can be generated; and, joint lesson-learning which can contribute to project sustainability.

LESSONS LEARNT ON EVALUATION: INDIA

To improve the quality of evaluation, there is a need for application of new and updated assessment methods, manuals and guidelines. There are several evaluation systems in place for the research projects conducted as well as for research programmes in the universities and research organisations.

- Enhancing the accountability of science and technology research evaluation (transparency, participatory approaches, etc.).

- Need for fighting the scientific misconduct (see also Area 1) by evaluation bodies at national and local level, courses on ethics in universities, etc..

There is a lack of methods to evaluate possible and probable risks arising out of impacts of S & D research.

There is a need to create autonomous professional body for carrying out “Ethical review” of research procedures.

For further information, see also:

Area 1: frames of responsibility 1, 2
Area 2: frame of responsibility 5
Area 5: frames of responsibility 23, 24
Area 6: frames of responsibility 30, 32
SUMMARY

Area 4 - Evaluation

Frame of responsibility 18:
Dissemination of evaluation practice

Practical Options
PO74: Promoting the monitoring and evaluation of research plans and projects at any level
PO75: Raising the awareness of researcher of the best practice of evaluation
PO76: Foster decision-makers to allocate adequate funding for STR evaluation
PO77: Implementing programmes to support continuous assessment

Frame of responsibility 19:
Quality of evaluation

Practical Options
PO78: Application of updated methods of evaluation
PO79: Production of evaluation manuals and guidelines
PO80: Developing shared evaluation criteria for STR policies
PO81: Harmonisation of different evaluation methods
PO82: Application of new accreditation methods towards research entities
PO83: Support of activities to promote post-accreditation quality
PO84: Benchmarking of good assessment practice

Frame of responsibility 20:
Adaptation of evaluation

Practical Options
PO85: Involving stakeholders in evaluation
PO86: Developing and spreading contextualised evaluation methods
PO87: Developing ad hoc evaluation tools
PO88: Evaluating the specific impacts of the different technological options
PO89: Making use of locally available expertise for evaluation

Frame of responsibility 21:
Transparency of evaluation

Practical Options
PO90: Defining public evaluation procedures
PO91: Creating commissions for an "ethical review" of research procedures
Frame of responsibility 22: Quality of evaluators

**Practical Options**

**PO92**: ENSURING TRANSPARENCY OF THE DECISION-MAKING PROCESS AS REGARDS EVALUATION

**PO93**: IMPLEMENTING PROGRAMMES TO IDENTIFY AND SELECT QUALIFIED PEERS AS EVALUATORS

Lessons learnt Kenya

- Innovative and participatory approaches towards evaluation and impact assessment are needed

Lessons learnt India

- To improve the quality of evaluation, there is a need for application of new and updated assessment methods, manuals and guidelines.
- Enhancing the accountability of science and technology research evaluation (transparency, participatory approaches, etc.) is necessary.
- There is the need for fighting the scientific misconduct by evaluation bodies at national and local level, courses on ethics in universities, etc..
- There is a lack of methods to evaluate possible and probable risks arising out of impacts of S & D research.
- There is a need to create autonomous professional body for carrying out “Ethical review” of research procedures.
Chapter Five

Area 5

Innovation

There are many factors impeding innovation. Not all of them have been sufficiently identified, understood and coped with by the players who, with various roles, are engaged in STR and its relations with society.

This STR socialisation area is centred on the interactions between research and production, as the main channel for innovation. It is important to say, in this context, that innovation processes are neither linear nor easy to control. On the contrary, innovation is shaped by many diverse kinds of interaction and negotiation, characterised by continuous change and blurring boundaries, also because a wide range of actors is involved, including researchers, entrepreneurs and operators (e.g. farmers), political decision-makers and civil society organisations.

Difficulties related to technology transfer have been largely studied, both at the national level (i.e., technology transfer from research centres to SMEs or from research centres to farmers) and at the international level. There is also a consolidated knowledge on risks related to approaches to innovation and technology transfer which do not adequately take into account social and cultural features of the national and local communities involved. The two Manifestos developed within the frame of SET-DEV stress the risks of an innovation which is unrelated to local and national needs, disregards the needs of the most disadvantaged layers of the population and does not take into due consideration the plurality of knowledge and technological options which locally exist (see the box).

The related issues include the presence of different approaches to innovation among scientists, decision makers, and entrepreneurs; the lack of trust between actors, e.g. enterprises towards research institutions and vice versa); the lack of stakeholders’ participation in the elaboration and implementation of innovation policies; little interest in technical innovation of decision makers; the economic exploitation of research findings; poor integration of teaching and research activities in many research centres; the difficulties in management of international initiatives related to technology transfer; the context features that influence innovation processes (e.g. the research and development expenditures, enterprise competitiveness, infrastructure availability, matching services and opportunities between stakeholders); the difficulties in scaling-up of the participative experiences in innovation at local level; the difficulties of recruiting new actors that can bear new knowledge and resources (e.g. entrepreneurs from the diaspora).
In dealing with these difficulties SET-DEV has identified the following frames of responsibility:

- technology and knowledge brokering;
- coping with technological plurality;
- attitude of research institutes to innovation;
- attitude of enterprises to innovation;
- promoting a research-based environment for innovation;
- juridical and financial enabling environment for innovation;
- people’s spirit of innovation.

### THE TWO “MANIFESTOS: FOR A CONTEXTUALISED INNOVATION”

(…) “This manifesto recognises that Africa is unlikely to build the scientific, technological and innovation capacity it needs simply by adopting research training schemes and technologies developed in the advanced countries and offered by development cooperation agencies. It is apparent that if Africa hopes to prosper and if world leaders expect globalization to foster sustainable development and poverty reduction, building indigenous Science, Technology and Innovation (STI) capacities of African countries is an absolute necessity. In today’s rapidly changing global economy, the critical economic development and socio-environmental sustainability question is no longer whether countries should build STI capacity but what type of capacity to build and how to build it, given each country’s socio-economic and bio-physical constraints. The case for Africa will not be an exception.” (…)

From The African Manifesto for Science, Technology and Innovation

(…) “This Manifesto argues for an India that uses science and technology for its own agenda; for a certain style of doing science and technology and for a science and technology policy that both transcend the dichotomy between experts and non-experts, that recognises alternative S&T domains. It will argue for using science and technology for the benefit of the people, and it will argue for including the rich variety of expertise, knowledge and experience available in Indian culture and society into that science and technology.” (…)

From the Knowledge Swaraj: An Indian Manifesto on Science and Technology
One of the major problems for innovation is the difficulty of "transmitting" knowledge and technology from one group of actors to another (e.g. from researchers to policy makers, business associations and civil society networks, etc). This difficulty is compounded by lack of channels and tools for actors to interact, lack of awareness on the part of actors of a given territory of innovations available in this territory, the exclusion of the beneficiaries of technologies from technology transfer processes, inability to transform new knowledge into real innovation. This makes it difficult to capitalise on knowledge and technology to make them part of a community’s heritage.

An important frame of responsibility, therefore, is promoting a brokerage process, a form of mediation to transfer knowledge in different contexts (social, professional, cultural, organisational, etc) which, without specific intervention, would not "naturally" make contact with each other. This process may involve the identification of exploitable knowledge, stable interaction among different actors, implementation of knowledge by transforming it into practical innovations. In this regard, some practical options can be identified, which are given here by way of example.

**Rationale**

**Practical Options**

**PO94: Involving the bearers of local forms of knowledge in the identification of appropriate technologies**

To choose technologies appropriate to the local environment it is beneficial to involve local experts at all stages of the process. This involvement could help to make these technologies more relevant and sustainable. In projects reviewed in India and Kenya by SET-DEV, local actors were fully integrated through joint consultation, information exchange, observation and experimentation. Such participation helps to identify appropriate technologies; to adapt them to the needs of stakeholders; to test and make the technologies fully operational.

**PO95: Fostering good and innovative practices**

It is important to foster the most interesting knowledge and practices that are produced in different areas (e.g. in the field of agriculture), so that they can become out-and-out innovations. This entails identifying the right conditions for their application, involving stakeholders at various levels, using the knowledge and practices in local and national decision-
making processes, and more. These processes have been studied in the framework of SET-DEV, for example in a case study in India, where new farming methods without the use of pesticides were first tried and then used in several other Indian states.

**PO96: Expanding the use of pilot programmes**

One way to transform knowledge into practical innovation is to employ pilot programmes to test new technologies. In implementing these programmes care should be taken over such aspects as design, planning, resource allocation, recruiting and briefing participants, monitoring, involving stakeholders, evaluating results and building on success. In some SET-DEV case studies (such as the one on the fight against crop pests in Kenya or the up-scaling of pest control techniques that do not use pesticides in India) special attention was given to the continuous formalisation of the results obtained and the gradual spread of these technologies to other areas, promoting visits and exchanges among farmers. Pilot programmes can also provide a bridge between research and decision-making (see Area 6).

**PO97: Establishing science and technology parks to promote collaboration between academia and business**

Science and technology parks have established themselves as a key tool to facilitate, accelerate and optimise brokerage is the field of innovation. Science parks offer facilities and services for applied research laboratories (public and private), while technology parks address enterprises, mostly operating in high technology sectors, and growth based on the exploitation of common entrepreneurial know-how. A World Bank study on innovation in India has recommended a number of initiatives in this regard (see box).
INDIA: EXPANDING SCIENCE AND TECHNOLOGY PARKS AND TECHNOLOGY INCUBATORS

“Technology parks and incubators should be expanded with government support and private finance and management, based on international best practice—including the experiences of Israel, Taiwan (China), the United Kingdom, and the United States. Managing these parks and incubators is a specialized job and requires intensive capacity building, training, and apprenticeship for mentors and financiers.

Spin-offs also should be encouraged from universities or public research labs to create new companies. Scientists should be allowed to start spin-offs while holding their current jobs. The public support programme should focus on the following:

- Creating a few high-quality science and technology parks near a cluster of research universities and public labs (such as Lucknow, Pune, Hyderabad, Bangalore, New Delhi, Vadodara, and Chandigarh) where companies would set up their R&D labs and help create synergies between the industry and scientists.

- Expanding the technology incubator programme to most public R&D labs, IITs, Indian Institutes of Management (IIMs), and research universities with adequate facilities, including proper capacity for strategic mentoring for such units following a professional approach and adequate nurturing of firms.

- Expanding common research and service centre programmes like CSIR’s TCGA—a novel public-private partnership approach creating an excellent research and service lab. All these activities should include a strong public-private partnership element.

- Promoting a “Technology Spin-Off Fund” to spur formation of new companies from R&D generated in labs and universities. This should provide seed and working capital, as well as business mentoring for such units.”


P098: Disseminating information on positive experiences in technological development at the national and local level

It is important to launch programmes to disseminate information on innovative practices with a proven positive impact in the technological field. Also the reference to failed experiments or negative experiences could be equally important to convey the dialectical process of knowledge generation. These programmes should target different types of actors and stakeholders and can include activities such as: production and dissemination of books and journals; production of documentation to be published on portals and web sites; conferences and seminars; broadcasts on national media. In the case of specific local communities, more appropriate communication tools can be used (e.g. theatre, radio and television broadcasts in local languages, etc) (See Area 3). In a SET-DEV case study, the fight against food crop pests in some areas of Kenya become a model imitated in the country and abroad, and the subject of numerous publications in scientific journals and even taught in Kenyan and foreign universities.

P099: Encouraging exchanges among the beneficiaries of different technologies

Under certain circumstances it is advisable to establish contacts between the beneficiaries of new technologies even if they belong to communities that are positioned geographically and culturally far apart to encourage an exchange of information and experiences. In a SET-
DEV case study in India of the use of environmentally friendly technologies in agriculture it was found that a bridging role can be played by local NGOs, which can provide organisational and logistical support and facilitate travel and meetings. Through on-site visits and distance dialogue, communication can make an important contribution to the development and application of such technologies.

**PO100: Using mass media and the Internet to spread appropriate technologies**

Some media are particularly useful in developing a framework of interaction between actors working in different places in the field of appropriate technology (different technological options, appropriateness in local contexts, applicability, etc). In particular, tools such as the Internet and local radio stations can be used. For example, in a programme to support ethno-medicine in the state of Gujarat in India extensive use was made of national and local radios to disseminate the results. Local and rural radio is an established tradition, which has for decades been used as an educational tool in the field of technology and health care (for details: http://www.fao.org/sd/ruralradio/en/index.html). Another example is the eSagu System (see box).

**eSAGU—AN IT-BASED PERSONALISED AGRO-ADVISORY SYSTEM**

**Practices**

eSagu is an IT-based personalised agro-advisory system where Internet, database and digital photography is used to improve the performance of agricultural extension services. It was developed by International Institute of Information Technology (IIIT) Hyderabad, Media Lab Asia sponsored the project. It increase yields in a short term and helps the small and marginal farmers to move to profitable farming management in the long run. It benefits the small and marginal farmers in the developing and under developed countries by adapting the scientific farming practices it reduces their cost of farming.

http://www.esagu.in

**PO101: Enhancing networking with scientific and technological diasporas**

Brokering activities, involving networking with scientific and technological diasporas, can be of particular importance for development in the native countries of expatriates. On this front, the government of Kenya, for example, has set up a special "Diaspora technical team", and India has long taken measures to facilitate the return of Indian scholars and promote distance cooperation. In this regard, interaction and support can be promoted and strengthened (for example, consultancy by members of the diasporas), mainly by means of the Internet.
The importance of **technological plurality** is clearly stated in the two manifestos produced in India and Africa within the SET-DEV framework that stress that innovation should be **relevant** to different social and cultural contexts, and the needs emerging from these contexts for the population and the economy. For this reason it is important to recognise that there are different technological options available, including those devised at the local level, and choose the more suitable one. The **risk** is that of imposing technological solutions developed in other contexts, which can produce negative impacts and at the same time inhibit and impoverish local technological heritage.

Therefore, the idea is gaining ground, at least in principle, that innovation should be based also on a careful examination of different types of **knowledge existing at the local level** among different population groups. However, there are many obstacles to overcome such as the persistence of a "supply side" approach to technical development; difficulties faced by researchers in identifying local know-how; poor knowledge of target social and cultural contexts; policy makers' lack of consideration for traditional technology and grassroots innovators, resulting in little work being done on the strengthening of local technologies.

The issue of technological plurality is therefore a fundamental frame of responsibility for the field of innovation for which a number of **practical options** can be identified.

### Practical Options

**PO102: Providing and evaluating technological option maps**

The creation and dissemination of specific maps of different technological options for solving a given problem can be a very useful tool. These maps may cover a particular technological sector (e.g. irrigation, energy conservation, housing construction, etc) at local, national or regional levels (See box). Usually, depending on the aim, such maps can be created by reviewing existing documentation, carrying out benchmarking activities, and interviewing national and local stakeholders.
Practices

In a SET-DEV case study carried out in Kenya the pest control technology called "Push and Pull" was developed by ICIPE (International Centre of Insect Physiology and Ecology) after carefully comparing "conventional" technologies with those existing at the local level.

Anthra is an Indian NGO started by two women veterinarians located in Secunderabad and Pune. Anthra is devoted to work among tribal and other marginalised communities, and their indigenous knowledge on livestock – ethnic breeds, traditional medications and plant drugs. The organisation collects and compiles all the available indigenous knowledge - the traditional animal rearing patterns, unrecognised ethnic breeds, traditional remedies and validates through several workshops and collaborating with scientists.

PO103: Identifying and promoting “demand side” rather than "supply side" technologies

An option that is gaining ground is the promotion of "demand side" technologies They are developed in local contexts and meet the real needs of the population. The various case studies promoted by SET-DEV in India and Kenya were studied from this perspective. This option contrasts with "supply side" technologies developed outside a particular social and economic context and then imposed by technocrats from the top. The practical application of the "demand side" technology option requires researchers to have a good capacity for analysis and dialogue. In projects based on this approach the methods used involve the preliminary study of the local technological heritage, consultation with the people (through group meetings, interviews, decision-making assemblies, etc). An example of the importance of a "demand side" approach is shown in the box below, which outlines the findings of a SET-DEV case study in India.

TECHNOLOGICAL PLURALISM IN POST-DISASTER RECONSTRUCTION: A CASE STUDY IN INDIA

Practices

“The construction industry’s ecological foot print is one of the biggest in terms of climate change and the case looks at how people’s choices can be reduced at the times of natural disasters during reconstruction with the built environment being transformed from one that has space for plurality to one that seeks to standardise construction and rehabilitation.

Through a detailed analysis of different responses to three big natural disasters in 21st century India the case shows how people’s choices can indeed be built into the reconstruction process often leading to better results for both the communities and the government. This would however require a more serious examination of the guidelines and the way they are constructed. The case shows how communities have been able to seize imitative in establishing plurality, sustainability and justice and how technologically responsible designers such as Laurie Baker have exemplified this in their work even as they continue to be ignored in mainstream professional architectural practice.”

Excerpt from: KICS, Piloting Knowledge Swaraj: A handbook on Indian Science and Technology, within the framework of SET-DEV project, 2010

PO104: Involving local social actors in innovation programmes

Since organised civil society actors (associations, NGOs, cooperatives, etc) often have a role in the production and promotion of local knowledge, they should participate in innova-
tion programmes at the local level. One of the many examples of the contribution that these organisations can make comes from India (see box), where the introduction of solar energy in tribal communities was accompanied by participatory research activities, support and monitoring.

NGOs and the spread of solar energy in India

Practices

Appapur and Rayaletipenta are hamlets in the Rajiv Gandhi Wildlife Sanctuary located in the Lingala and Amrabad mandals of Mahbubnagar district (Andhra Pradesh). Forty families belonging to the Chenchu community, a primitive tribe are living in the hamlets. They do not have access to conventional energy sources and are prohibited from using forest wood by the existing forest laws. Hence, these hamlets were chosen for powering with solar energy by providing street lighting, home lighting, individual lanterns energy for community TV and solar driers. The forty households were the first in Rajiv Gandhi Wildlife Sanctuary to utilise solar energy. Home lighting systems, independent solar lanterns, street lighting system and Community TV were installed in the forty households.

The implementation of the project started with the undertaking of Participatory Research Action (PRA) exercises, site mapping, conducting joint and separate meetings of men and women, strengthening self-help groups, improving leadership, site visits by technical experts. The technology providers carried out the installation with the active involvement and support of a local NGO, EPTRI, NEDCAP and local community leaders.

All the equipment installed was covered under service contract for a period of 5 years. Local people were involved actively right from the beginning of the programme and adequately trained to maintain the equipment installed with the help of a local community head after the warranty period is over. The local community head is collecting nominal charges from the beneficiaries and thus created a fund, which will be used for maintenance of the equipment created under the project. The local NGO is closely monitoring the programme and rendering advice and assistance to the community whenever they sought.

http://www.eptri.com/n%20rural.html

PO105: Setting up “learning alliances” with the participation of public and private actors, researchers, and civil society

To deal with particularly complex challenges - such as promoting innovative sustainable technologies on a scale larger than the local level (e.g. village, prefecture, etc) - structured forms of partnership should be set up with public, private and civil society actors. Unfortunately, appropriate models of reference are often missing. A particularly interesting case is "learning alliances", existing in experimental stage in India, where a key role was played by CWS, a SET-DEV partner (see box).
LEARNING ALLIANCES IN INDIA

Practices

“Learning alliances” are a series of “platforms” interconnected at different institutional levels (national, district, community) and constructed with the aim of bringing together all stakeholders in a process of innovation or the creation of new knowledge in an area of common interest (ex. the intensive rice cultivation in Orissa - India). Actors must have complementary skills which, when combined, can translate new knowledge into innovation at different levels of scale. Capacity is required for implementation, regulation, definition of policies, research and learning, documentation and dissemination.

Shambu Prasad et al. 2007

PO106: Assuring respect for local cultures in promoting and regulating new technologies

At a time when innovative technologies (such as ICT) are being promoted, disseminated and regulated, it is essential to ensure respect for local cultures. A key issue, for example, is privacy on the Internet (see box, concerning a specific SET-DEV Work Package). The application of this approach requires inter-linked activities such as: create an inter-disciplinary “team of teams” to examine, measure and advise about impact and take-up of new technologies by indigenous peoples; establish relative cultural values, gauge awareness and attitude of indigenous peoples to new technologies; identify and/or create fora wherein cultural values, awareness and attitudes of indigenous peoples are incorporated into wider-policy-making and legislative process; use teams to report feedback about new policy and legislative developments to indigenous peoples, preserve and promote cultural elements using new technologies, devise and maintain regular measurement of technology impact on these communities; use teams to devise and deploy technology-enabled solutions which may help bridge urban-rural divides especially in areas like education, health-care and agriculture.

TECHNOLOGY-DRIVEN REGULATION IN EMERGING ECONOMIES: THE RESPECT FOR LOCAL CULTURES

(...) "The SET-DEV team’s field-work with five indigenous peoples in Kenya (Ogiek, Samburu, Pokot, Turkana and Giriama) confirmed that members of these communities are sensitive to many elements of “private and family life” and indeed that many areas of sensitivity are prima facie shared with their urban as well as their Western counter-parts. Sexual and body activity, intimate family relationships, business dealings and their use of modern mobile communications technology would appear to be governed by sentiments of privacy not dissimilar to those of urban dwellers in most other societies. Local traditions may have resulted in information about some activities (e.g. initiation rites or political beliefs) being more or less closely guarded than in urban or in Western societies but these local differences are small in comparison to the similarities in attitudes to information policies that these peoples have. The impact of economic circumstances on privacy remain those well known in research literature over the centuries: where scarcer financial resources compel families and larger communal units to live in relatively confined spaces the opportunities for and expectations of privacy appear to be somewhat lessened though the “basics” never disappear altogether. Indeed, some of the research results suggest very tentatively that the arrival of new technologies such as mobile telephony and mobile internet permit the creation of new virtual space that acts as an extension of physical space and this is greeted with some joy by certain sectors like some women and youth who rejoice in the achievement of a space not as closely controlled by their men folk or older generations (who on occasion, depending on the society, may dictate anything from voting during political elections to whom and how
they do business with).

While empirical research with indigenous peoples within SET-DEV WP9 revealed various forms of concerns with privacy at grass-root level, there seems to be a disconnect with mechanisms for reflecting such concerns at legislative and other policy-making levels. There does not appear to be a structured way of examining traditional attitudes to privacy (or other personal and societal values) across various ethnic and indigenous groups within the country and then using evidence-based research to back up or otherwise inform the legislative and other policy-making processes which would e.g. provide for protecting and promoting privacy in social context marked by rapid technological change. This disconnect was investigated at first hand in Kenya and only through literature and interview in India but the situation in both countries would seem to be largely comparable i.e. the divides between urban and rural areas are replicated in the extent to which the views and cultures of indigenous peoples are taken into account in those areas where these cultures may be impacted by technological change. It would appear to be a matter of sound policy to institute mechanisms which would systematically measure cultural attitudes and traditions across both rural and urban contexts in such a way so as to then a) permit the impact of technological change to be more accurately forecast and provided for; and b) introduce technology-related legislation which reflects and respects national sentiment and traditions while allowing for compatibility with external and especially western legislative standards.(…)

Excerpts from SET-DEV WP9 draft documents

**PO107: Making use of local materials whenever possible**

In activities based on innovation and technological pluralism it is important to consider the origins of materials to be used. As shown in the case study conducted in India on the effects of the tsunami in Tamil Nadu, it proved beneficial for the rebuilding effort that the project foresaw maximum use of local building materials.
FRAME OF RESPONSIBILITY 25

ATTITUDE OF RESEARCH INSTITUTES TO INNOVATION

▪ RATIONALE

The changes taking place in the world of STR require research centres to be more receptive to innovation in organisation and strategy. However, this is not always the case. In universities, in general, applied research tends to have a low status, and very little thought is given to what is called the "third mission" (links with territorial economic and social development), in addition to the traditional missions of teaching and research.

In this regard, SET-DEV identified numerous problems, such as low relevance of applied research (e.g. in agriculture, sanitation, etc.) compared to the expectations of local stakeholders; a gap between academia and industry, related to such factors as different quality of knowledge produced by universities and the industrial sector, working procedures and hours, bureaucratic obstacles, conflicting views on how to manage intellectual property etc.; gaps in university curricula as regards innovation, i.e. the lack of specific training curricula providing students with a relevant knowledge base on innovation; research institutions avoid involvement in independent technological research and prefer to adopt solutions developed abroad; low productivity of some research centres in terms of inventions and spin-offs; universities show little interest in small and medium enterprises; lack of interest on the part of scientists in the application of research results after projects have ended (especially in the context of studies funded by international donors); differences in expectations, times and operational procedures between research institutions and industry; difficulties for patenting; lack of trust towards enterprises.

Faced with the risk of a disconnection between researchers and production, numerous policies, programmes and experiences of great interest are being developed, as identified by SET-DEV, which, beyond their intrinsic value, offer important information and indications about trends in this problematic relationship.

These are some practical options related to this crucial frame of responsibility.

▪ PRACTICAL OPTIONS

PO108: Creating market oriented research and educational institutions, centres and networks

To facilitate the creation of bridges between research and industry market-oriented research should be encouraged in scientific centres and education institutions. It is critical to coordinate activities to promote information, awareness, dialogue and cooperation for researchers working on programmes and projects related to innovation. They can also provide
support for specific problems like patenting (see also below FR28). In Kenya, for example, despite the general lack of interest in the production sector, various universities have at least one structure involved in dissemination activities. Some universities have also begun to provide assistance to small and medium-sized businesses. In some cases, specific networks can be launched. For example, with the establishment of the Indian Institute of Scientific Education and Research the government of India aims at creating hybrid institutions, which bridge the gap among different departments, in order to produce large numbers of science graduates and postgraduates oriented towards the commercial application of science (Bound 2007).

**PO109: Updating academic curricula, by introducing the issues of innovation and appropriate technologies**

A particularly appropriate type of action to foster innovation within universities is to update academic curricula, introducing the issues of innovation and appropriate technologies. In SET-DEV case studies, for example, Egerton University (Kenya) included innovation in their educational curricula as part of a broader set of initiatives aimed at fostering relationships between academia and production. This type of intervention can have a positive impact, creating a core of teachers and teaching focused on innovation issues and offering courses for a new generation of researchers on this field.

**PO110: Introducing programmes that motivate researchers to develop interest in innovation issues**

It is important to promote, at the local level, programmes designed to research institute staff to develop interest in innovation. This can be done through incentives, either material or symbolic, and especially through awareness-raising initiatives. The latter help to encourage a change in mentality, a spirit of trust, favourable conditions for dialogue with the world of production and its different components. Such programmes usually include initiatives such as seminars, briefings, and conferences.

**PO111: Promoting exchanges between researchers and representatives of the productive world**

To overcome researchers’ mistrust and lack of faith in those involved in production (and vice versa) opportunities to meet and exchange ideas should be promoted. In this regard, brokerage services of various kinds have been successfully experimented with nearly everywhere, together with initiatives such as exhibitions, open days at universities, visits, seminars and informal meetings. Egerton University (Kenya), a SET-DEV case study, uses such initiatives to foster interaction and create partnerships with existing local businesses.
FRAME OF RESPONSIBILITY 26

ATTITUDE OF ENTERPRISES TO INNOVATION

Many firms, especially medium and small ones have a problem of attitude as far as innovation is concerned.

SET-DEV has revealed that many companies do not focus on innovation; do not allocate sufficient time or resources for investment in innovation; are reluctant to take risks and introduce changes; show diffidence towards research institutions regarding them as unable to find practical solutions to their problems; incompatible approaches, timelines and intervention procedures with other actors of the “triple helix” (or rather the “quadruple helix”, if we include the civil society – see areas 3 and 6); are either unable to use local research or reluctant to accept new technologies developed locally. There is also a relatively low educational level of small and medium entrepreneurs and the poor quality of training within companies.

Together these difficulties represent a strong deterrent to innovation, even if they are the focus of concern for many institutions, both public and private, in India as in Kenya and Africa in general. The fact remains that, due to their strength, ubiquity and entrenchment, these issues remain largely unresolved in many regions and production sectors. This makes it a specific frame of responsibility, concerning which the following practical options can be identified.

PRACTICAL OPTIONS

PO112: Supporting private actors in promoting research

Since one of the main obstacles to the full participation of enterprises in innovation is the negative attitude of their managers, it is particularly important to carry out awareness-raising and support initiatives that highlight the economic and social importance of research and the role of research in enterprises of all sizes. The main types of activities in this area include seminars and meetings given by experts and business people and meetings with representatives from the science and technology research community. An interesting experience, studied by SET-DEV, is, for example, the Kenya Management Assistance Programme (see box).
The Kenya Management Assistance Programme (KMAP) is a voluntary business community body. KMAP was set up in 1986 by a group of large companies in Kenya with the mandate to facilitate improvements in the management of small and medium size firms in Kenya. The programme, which has a staff of 18, depends on member companies to provide the bulk of the personnel who train, counsel and advice small and medium size business owners.

On joining, each KMAP member company agrees to release its management personnel at the rate of one manager per day per month to KMAP. Each of the companies designates one of its executives as a liaison manager to coordinate arrangements. Since 1993, KMAP has been inducting professionals from outside the member companies into its pool of experts who are referred to as counsellors. Currently, there are 800 of these counsellors.

KMAP’s clients are served from Nairobi head offices, two branches and a mobile unit. The Nairobi offices host the secretariat and cater for clients from Nairobi and surrounding areas. The two branches are in Mombasa, which serves Coast Region, and Eldoret, which is responsible for clients from Rift Valley Province and Western Kenya. The mobile training unit is used to cover the remaining parts of the country.

Initially, there were 74 member companies. Today, 258 firms are members of KMAP. Firms wishing to benefit from KMAP services need to register and are charged fees at the rate of Kshs.10000.00 (US$128.2) for start-up businesses and Kshs.35000 (US$448.7) for existing firms. KMAP currently has 17,000 clients.

Ngesa, Ombati, Mutuku 2003; Hitchins, Gibson 1998

**PO113: Supporting private actors in identifying research needs**

Support should be given to firms to find out what research has to offer them in their field. To facilitate a positive attitude to research it is important to help companies to identify their knowledge needs so that they can develop their own innovation programmes. To this end, specific initiatives to provide advice and support can be set up by the government, business services and researchers at national and local level.

**PO114: Promoting training in small and medium-sized enterprises**

To get small and medium-sized enterprises to focus more on innovation and create the necessary knowledge and skills to implement programmes in this field, it is crucial to develop special training programmes. These programmes may involve the theme of innovation in general and/or more specific topics concerning the target areas of beneficiaries. They are usually promoted by business networks or business services and are more effective if designed and implemented at the local level and involve directors of companies and their key officials. It is important that support and coordination is provided by specific government bodies: in India, for example, the Small Industries Development Organization, under the Ministry of Small Scale Industries, serves as India’s nodal development agency for small enterprises. Its entrepreneurship development programmes include specific training activities for businesses.
FRAME OF RESPONSIBILITY 27

PROMOTING A RESEARCH-BASED ENVIRONMENT FOR INNOVATION

- **Rationale**

Innovation requires a **favourable cultural and organisational environment**, in which research is promoted as a factor of economic and social progress, and where existing local knowledge and experience can be put to use for the good of the community.

In reality, there may be **problems of various kinds**, such as lack of awareness on the part of political, social and economic actors of the link between innovation and development in a given area; the difficulty of up-scaling or mainstreaming successful experiences; bureaucratic obstacles of various kinds; the absence or lack of networking services for local innovation actors, etc. These problems, which emerged in the course of SET-DEV activities, have been addressed by many public, private, non-governmental and international actors, who have carried out important studies and experiences in this field, both at national and local levels.

Promoting a **research-based environment for innovation** as a frame of responsibility is linked to following practical options.

- **Practical Options**

**PO115: Supporting the up-scaling of positive local experiences in the field of innovation**

It is important to support the up-scaling of positive local experiences in the field of innovation. In this way, these experiences are developed, disseminated and consolidated. A particularly interesting example of up-scaling in the field of agriculture has been found in India and studied by SET-DEV (see the first box below). The importance of up-scaling "inclusive innovation" has also been underlined in a recent report on innovation in India (see the second box below).

**UP-SCALING OF NON-PESTICIDAL METHODS OF PEST MANAGEMENT (NPM) IN ANDHRA PRADESH**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The NPM approach is a unique example of innovation in civil society where knowledge of farmers and dissenting agricultural scientists have been combined to provide practical alternatives to farmers on a large scale. This approach has already been upscaled in about 13 lakh acres with 6 lakh farmers through a Community Managed Sustainable Agriculture (CMSA) programme in Andhra Pradesh. The case involves not just technological innovation in the manner in which pests have been understood and dealt with indicating possibilities of a non-violent science but also has been based on several institutional innovations that have</td>
</tr>
</tbody>
</table>
enabled this scaling up. It is being implemented / managed since last 5 years by a new learning alliance consisting of (i) Autonomous organisations under the state government namely SERP (at state level) and DRDAs (at district level), (ii) A consortium of NGOs including CSA (at state level) and other NGOs (at district level), (iii) Sustainable CBOs namely SHGs and their federations at village, mandal and district levels, (iv) Successful farmers and (v) local entrepreneurs in respective areas. Currently the programme is spread over 3000 villages (in 20 districts) out of which more than 140 villages have already become pesticide free. Striking features of the approach are (i) reduction in cost of pest management without any reduction in yield, (ii) easy access to pest management measures (since these measures are worked out at village level through locally available raw material), (iii) reduction in medical expenses on account of hazardous effect of pesticide use as well as residual toxicity in the vegetables and food crops; (iv) less dependence on money lenders / input dealers for provision of credit, external inputs, etc.

Before starting the upscaling programme, an intensive R&D work was carried out by CWS and later its sister organisation CSA, which resulted in a pesticide free village (at Punukula) in Khammam district where cotton is a major crop. Afterwards the NPM approach was, demonstrated by WASSAN, over an area of 430 acres with 300 farmers in 14 villages of Kosgi mandal on the institutional platform of women SHGs and their federations. Based upon the above experiences the NPM approach has been upscaled by SERP through its own financial resource during initial 2 years and through RKVY support during subsequent years.”

Excerpt from preparatory documents of Pilot Programme India (SET-DEV), 2009

INDIAN INCLUSIVE INNOVATION: SCALING UP PRO-POOR INITIATIVES

“India would benefit from fostering more inclusive innovation—by promoting more formal R&D efforts for poor people and more creative grassroots efforts by them, and by improving the ability of informal enterprises to exploit existing knowledge. Existing pro-poor initiatives need to be scaled up. Inclusive innovation can play a critical role in lowering the costs of goods and services and in creating income-earning opportunities for poor people. The Council of Scientific and Industrial Research has developed technology applications for rural India, and university and formal private initiatives (such as e-Choupal and Amida’s Simputer) have delivered benefits. The National Innovation Foundation has a repository of more than 50,000 grassroots innovations and traditional knowledge practices.

And a number of initiatives exist to help the informal sector better absorb knowledge. More favourable matching grant support for pro-poor early-stage technology development could significantly increase collaboration among public R&D entities, universities, nongovernmental organisations, national industries, and global networks. Increased support for grassroots innovators could be provided to the National Innovation Foundation to scale up impact. To leverage traditional knowledge into revenue, a policy-oriented intellectual property rights think tank could propose how to implement a cheaper intellectual property regime. Finally, successful technology upgrading programmes could be extended to help informal and rural enterprises make better use of existing knowledge.”

Excerpt from Dutz 2007
**PO116: Identifying and amending bureaucratic mechanisms which make innovation more problematic**

Policy makers and administrators, along with other social, economic and research actors should promote programmes that identify and correct the bureaucratic mechanisms that hinder innovation in various ways at national, transnational, and local levels. Red tape may include long waiting times for permits and licenses, organisational bottlenecks, etc. Experience accumulated in Europe, India and Africa, suggests the following countermeasures for excessive bureaucracy: setting up observatories on bureaucratic problems, working groups involving decision makers and entrepreneurs to suggest solutions, and monitoring structures (especially at decentralised level).

**PO117: Creating and promoting information and consultancy services**

Creating local decentralised information and consultancy services for businesses, farmers, etc, can be crucial for innovation. These services can help enterprises to overcome alienation they may feel towards the themes of innovation and provide them with concrete intervention instruments. For example, the Kenya Industrial Research and Development Institute (KIRDI) and the Kenya Industrial Estates (KIE) offer extension and consultancy services to small and medium enterprises in the country. In addition, a service was set up within the business world, the abovementioned KMAP, which offers a wide range of business services. India, too, of course, has several initiatives in this area (see box below).

**INDIA: THE TECHNOLOGY BUREAU FOR SMALL ENTERPRISES**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Indian Ministry of Small Scale Industries, as one of its enterprise support services, set up a Technology Bureau for Small Enterprises. “This bureau provides technology information (online databases on technology options), match-making (networking and assistance in drafting agreements and preparing business plans), finance syndication (loans, venture capital, and interest-free loans to meet initial expenditures in the pre-technology absorption stage), and business collaboration (support for exporting technologies), as well as support services (arranging consultancy services and visits of overseas experts, and coordinating buyer-seller meetings). The bureau is a joint initiative between the United Nations Asian and Pacific Center for Transfer of Technology, the Small Industries Development Bank of India, and the Small Industries Development Organization.”</td>
</tr>
</tbody>
</table>

Excerpt from Dutz 2007

**PO118: Promoting services that facilitate networking among actors interested in innovation issues**

Networking services should be set up at local, national and international levels for actors involved in innovation processes. These services, whether set up by government actors or other stakeholders, can provide researchers, policy makers, entrepreneurs and civil society representatives the opportunity to meet and exchange information and experiences in a structured and continuous fashion. This can be accomplished through such instruments as seminars, meetings, databases and websites, online discussion groups, or through different stakeholder networks. Some services have already been explained in previous POs. Mention should also be made of the Federation of Asian Biotech Associations (FABA), formed with the goal of setting up a common framework for the development of biotechnology, involv-
ing the participation of research institutes, private institutions and the government of Andhra Pradesh.

**PO119: Promoting partnerships between universities and enterprises**

It is important that collaboration between academia and the business community transforms into long-term partnerships. An interesting example in the European context is "responsible partnering" (see box).

**RESPONSIBLE PARTNERING**

```
"Responsible partnering is a voluntary code of conduct for innovative companies and public research institutions to enable them to collaborate more effectively (...) developed by experienced practitioners of collaborative research from 4 European associations representing the needs of Industry (EIRMA), Research & Technology Organisations (EARTO), Universities (EUA) and Knowledge Transfer Organisations (ProTon Europe), with the support of the European Commission".

Two principles underpin Responsible Partnering: the principle of maximum Beneficial Use of Public Research (benefits appear only when knowledge is disseminated and put to productive use) and the principle of Responsible Use of Public Research (with respect both to the relations among partners and to the relation of the partners towards the public at large).

In order to develop these principles into action, 10 guidelines are identified: aligning interests; treat collaboration strategically; organize for lasting relationships; provide the right professional skills; establish clear intent; use standard practices and communicate regularly; achieve effective Intellectual Property; provide relevant training; view innovation as a trans-disciplinary activity.

```

**PO120: Information and awareness building on territorial innovation**

Greater understanding of a link between innovation and territory should be promoted among administrative, social, economic and research actors. On the basis of experience in the three regions examined by SET-DEV, the mobilisation of energy and resources and the positive impact this can have on the local community is of central importance. In this regard, information and awareness building initiatives on territorial innovation initiatives can be organised, such as meetings and seminars with representatives of different types of public, private and civil society actors. All of this should be inspired by the drive to integrate innovation in local policies of development, preservation of environment and valorisation of cultural endowment.
FRAME OF RESPONSIBILITY 28

JURIDICALLY AND FINANCIALLY ENVIRONMENT FOR INNOVATION

**Rationale**

Innovation requires coordination and promotion, a normative infrastructure (but without too much red tape) and financial support at various levels. Research conducted in this field, as well as the studies and initiatives undertaken in the framework of SET-DEV, has revealed several problems in this area, which pose a serious challenge for innovation processes.

These problems include barriers to inter-institutional links among government bodies involved in supporting innovation; lack of political support in terms of funding and coordination to organisations in the domain of Science Technology & Industry; constraints on industry due to over-regulation; lack of funding for innovation, early-stage technology development and for the assimilation of technologies by micro, small and medium enterprises; inadequate incentives for innovation and marketing activities for university spin-offs and government research centres, technology transfer offices, researchers who wish to market their intellectual property, and science parks and incubators; lack of support from credit institutes; gaps in legislation on intellectual property, such as compensation for researchers, management of the negative effects of cost of medicine and seeds on poor people, etc.; difficulties in implementing new legislation on intellectual property.

Governments and local authorities are presently trying to address these problems by enacting new legislation, creating coordination bodies and involving a greater number of actors who can financially support innovation. Thus, the juridical and financial enabling environment for innovation is an important frame of responsibility. In this regard, several practical options should be mentioned.

**Practical Options**

*PO121: Strengthening government coordination structures in the field of innovation*

Coordination of different institutional structures involved in innovation is essential to avoid overlap, conflict of interest and waste of resources. Such coordination is provided in India by institutions such as the Ministry of Science and Technology and in Kenya by bodies such as the Ministry of Higher Education, Science and Technology (MoHEST) and the National Council of Science and Technology (NCST). Coordination of this kind can be carried out typically through such measures as the identification of an impartial coordinating institution, the creation of ad hoc committees or working groups and the creation of relevant authorities.
Po122: Creating further opportunities for public and private funding of innovation

It is of crucial importance to create new opportunities for public and private funding for innovation, set up initiatives, and facilitate completion, up-grading and up-scaling. These opportunities can usually be identified and made operational through specific awareness raising programmes, networking, partnerships involving public and private actors, institutions, and international cooperation. For example, a strong public-private partnership was launched in the field of biotechnology in India (see box below). Another example was observed in Kenya (see below).

**Public-private partnership to fund biotechnological research in India**

Practices

“(…) In 2004, the Department of Biotechnology released a plan to turn India into ‘a global hub for bioinformatics’. The Confederation of Indian Industry argues that this represents the biggest opportunity for the Indian IT industry since its huge volume of work on the millennium bug. As biotech becomes more dependent on computation, so India’s position could strengthen.

Public-private partnerships, still rare in other sectors, are developing fast in bioinformatics. World-class facilities like The Centre for Genomic Application supercomputer research centre in New Delhi should provide an open platform for research. (…)”

Excerpt from Bound, 2007

**Kenya: looking into tea leaves**

Practices

This project, launched in 1995, involved the Tea Research Foundation of Kenya, Kenyan tea producers, and HP Agricultural (India). It aimed to broaden the genetic base of tea cultivars in Kenya, greatly reduced due to the massive use of cloning. The cultivation of a greater number of varieties reduces risks and increases overall resistance to natural disasters, climate change, and co-evolution factors like pests and diseases. The project involved research to assess the cultivars present at the national level, through the innovative technique of Molecular Genetic Markers, which can distinguish different varieties with great precision. In short, the project introduced a system for the identification, use and conservation of different cultivars, which, through national policies, have been introduced to areas where they were most needed.

Numerous farmers were involved in the plan through demos, workshops and publications. The farmers who participated in the project, organised by interest groups, formed then a bridge between researchers and farmers to carry out the evaluation.

The project involved a total of about 30,000 farmers. In addition to being an important experiment in dialogue and collaboration between researchers and beneficiaries, it also led to the public dissemination of information on molecular markers and risks associated with a reduced genetic base.

UNDP 1999
**PO123: Supporting a stronger engagement of credit financial institutions in the innovation field**

Particular attention should be given to the role of credit institutions in innovation programmes at various levels. Specific programmes should be activated to raise awareness and promote involvement. Credit institutions should be involved in particular in supporting innovation at grassroots level, which is often overlooked. In this regard the following initiatives can be taken: creation of working groups involving credit institutions, decision-makers and researchers; organisation of seminars and meetings between credit institutions and inventors; launching of public communication efforts in support of the role of credit institutions in local development. Funding models at the national level, supported by governments (see box), can create an environment conducive to the greater involvement of banks.

<table>
<thead>
<tr>
<th>INDIA: CREDIT-LINKED CAPITAL SUBSIDY SCHEME FOR TECHNOLOGY UPGRADEING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practices</strong></td>
</tr>
<tr>
<td>This scheme aims to facilitate technology upgrading by providing upfront capital subsidies to small enterprises for modernizing their production equipment and techniques. The ceiling on loans is Rs 1 crore ($24,000), and the subsidy rate is 15 percent. The Small Industries Development Bank of India and the National Bank for Agriculture and Rural Development are the nodal agencies for the scheme’s implementation.</td>
</tr>
</tbody>
</table>

Excerpt from Dutz 2007

**PO124: Introducing fiscal incentives for companies performing R&D**

Because enterprises, especially small and medium ones, often have limited financial resources to spend on innovation, it is important to provide them with specific incentives. For example, as proven by many examples at the international level, and as suggested during discussions held in the framework of SET-DEV in India and Kenya, tax incentives for companies performing R & D are particularly effective.

**PO125: Providing financial support to technologies that can prevent negative social and environmental impacts**

Enterprises should be made aware of the environmental and social impacts of technology. To this end, as shown, for example, by SET-DEV research in India, financial support can be provided to companies that develop technologies different purposes (environmental, agricultural, construction, water supply, etc.) to prevent, or resolve negative environmental and social impacts.

**PO126: Enhancing the protection of intellectual property rights**

To support innovation, specific intervention is required to protect intellectual property rights (IPR). This involves, for example, making the patenting process faster and more efficient by strengthening services, the training of qualified personnel, and continuous monitoring of services. This is a very important issue for a country like India: the oft-mentioned CSIR has been defined as "the most prolific patenting organisation in the developing world (Bound 2007). As established by a research programme conducted in Africa by ACTS, an analysis of policies and experiences in this regard may provide important practical solutions (see box).
The intention of this project is to undertake a comprehensive regional assessment on the state of research, capabilities and policy receptivity in intellectual property rights protection (IPRs) relating to trade. Specifically, the project will focus on the state of research and policy analysis in IPRs relating to trade, existing capacity, level of policy analysis and demand, institutional capacity, communication of research findings and adequacy and effectiveness of research networks in IPRs. The guiding rationale for this project is that effective capacity in IPRs is an important factor in ensuring consistent and broad participation for African countries to negotiate effectively in WTO. Further, some of the same capacities and technical expertise required for IPRs research are also important for sustainable development policy implementation at national and regional level in Africa.

www.acts.or.ke
When speaking of innovation in the context of STR socialisation, an important but often overlooked aspect is what might be termed the "innovative spirit" of the population, i.e., the readiness of the society to support innovative initiatives and experimentation that bring new technological solutions to the problems it faces.

This spirit of innovation is often hampered and suppressed by the lack of information about and awareness of the benefits of new technologies, a distrust of certain types of actors (researchers, engineers, etc), lack of affinity towards technology due to previous negative experiences (e.g. in cases where certain technologies have been developed around a table and imposed from the outside).

As shown by many examples around the world and by SET-DEV promoting an innovative spirit among the population may have positive effects including creating an environment conducive for dialogue between researchers and other stakeholders, facilitating an informed selection of the technological options that exist for a given problem, energising the population in terms of local knowledge and inventiveness. It is, therefore, a significant frame of responsibility, concerning which the following practical options can be highlighted.

**Rationale**

**Practical Options**

**P0127: Promoting awareness-raising initiatives on innovation as a tool to solve social and economic problems**

To promote or strengthen a spirit of innovation, specific awareness-raising initiatives are particularly important. As Indian experience demonstrates (see box) these can involve meetings and seminars on the role of innovation to solve specific economic and social problems, also at community level. In the context of these initiatives, discussions can focus on such crucial issues as inventiveness and innovativeness as attitudes to be promoted at the individual, social and economic levels. In some situations, moreover, the resolution of specific problems is a way to promote a new awareness of technology, as in the case of a programme in Gujarat (India) on the reconstruction of buildings after an earthquake (see box). A particular importance should be attributed to local awareness-raising initiatives addressed to young people, including those of school going age.
GUJARAT (INDIA): NEW APPROACHES TO POST-DISASTER RECONSTRUCTION

"The Gujarat earthquake reconstruction was tremendously supported by the progressive and people-friendly Owner Driven Reconstruction (ODR) approach and supportive policies and regulatory mechanisms. It saw a variety of approaches in reconstruction methodology that combined people, policy, funding and implementation in different ways to suit the specific context. (...) The majority of the people who reconstructed their house under the ODR approach employed construction materials with which they were already familiar, such as bricks, stones and wood. Many people succeeded in rescuing some material from their old houses. Most houses were reconstructed in situ following vernacular designs and spatial arrangements, so that the villages reconstructed with Government financial assistance maintained their traditional character. Some people however also introduced innovations, such as flat roofs reflecting the changing tastes and preferences and a selective adoption of new designs, building technologies and construction materials. Such diversity did not only reflect variations in local values and aesthetics, but also variations in housing requirements."

Excerpt from: KICS, Piloting Knowledge Swaraj: A handbook on Indian Science and Technology, within the framework of SET-DEV project, 2010

P0128: Trust building activities for local people on innovation issues

When cooperating with local communities, above all those which have had previously negative experience of technological development or transfer, it is essential to create an atmosphere of trust. This can be done through special meetings and seminars with the participation of a wide range of stakeholders that precede the implementation of proposed new technological programmes. In general, it is essential to ensure full and effective involvement of these stakeholders in all phases of a project (see box).

KENYA: TRUST AND INVOLVEMENT OF STAKEHOLDERS FOR A “CULTURAL GROUNDED TECHNOLOGY”

In the framework of a project to combat plant pests, scientific research and continuous sharing of knowledge with farmers enabled ICIPE to develop a real “cultural grounded technology”, which has consequently been adopted very easily by end users. The end-users have been involved in all research stages and contributed to the fine-tuning of the technology once it was brought from trials to fields. ICIPE also encourages farmers to first understand the technology and then invest in it by for instance buying the desmodium seeds. This provides the farmers with motivation to value the innovation as their own as they have a stake in the process. (…..)

From the Kenya Handbook

P0129: Prompting "lab work" at several levels

Promoting the spirit of innovation at local and community levels does not only involve providing information or raising awareness, but also taking initiatives that integrate discussion and practice. To this end, as shown in SET-DEV case studies in India, it is important to prompt forms of "lab work" at several levels (technology development, knowledge production, etc). This may involve, for example, integrating design, development and gradual test-
ing of certain technologies, collaboration between researchers and local stakeholders, to be considered researchers in their own right and field investigators.

**SOME ASPECTS OF INNOVATION IN INDIA: ACADEMIC RESEARCH AND LOCAL EXPERTISE**

In India there are organisations such as the National Innovation Foundation, an institution that documents local expertise. There are CSOs such as Dastakar in Hyderabad who are promoting local expertise in areas such as handlooms in Andhra Pradesh.

Project SET-DEV brought together the academia and the CSO Dastakar Andhra and involved them in discussions about the causes and consequences of enhancing the local expertise among the handloom weavers. SET-DEV partners recognise the potential of the CSOs to produce knowledge.

Excerpts from University of Hyderabad SET-DEV working papers
### LESSONS LEARNT ON INNOVATION: Kenya

- **Identifying the economic benefits of new technologies will facilitate their take-up**
  Evidence shows that the adoption of innovations and new technologies will proceed more quickly if they are seen to bring economic benefits to, and/or provide income-generating opportunities for, their users.

- **There is scope for building partnerships between the STR community and the informal business sector**
  The informal business sector in Kenya will continue to provide the major source of employment in the foreseeable future. There is considerable scope to enhance the quality and innovativeness of the products of the sector through strengthening its linkage to actors in the STR community who can conduct research into, and test, appropriate technologies and innovations for production by the informal sector.

### LESSONS LEARNT ON INNOVATION: India

- Need to establish **better linkages between the world of research and the world of production** in specific sectors at any level, by (inter alia) updating academic curricula, promoting exhibitions and open days in universities, enhancing the exchanges with producers and enterprises.

- Enhancing research and experimentation on **sustainable technologies**, and the use of local materials and cultures in promoting and regulating new technologies.

- Need for activities to involve and build the trust of **local social actors in the innovation programs**.
  - In areas such as agriculture, there is a need to **foster innovative and good practices of extension services**, activating pilot programmes.
  - There is a requirement to **sensitise and support small and medium-sized enterprises in promoting research**, identifying research needs, as well as promoting information and consultancy services.
  - There is a need to **enhance and strengthen the process of facilitating the patenting process** of the innovations that occur in laboratories, disseminating information on intellectual property regulations.
  - There is a need to **create opportunities for public and private funding of innovation initiatives**, promotion networking services and incentives for innovation in research institutions, develop essential commercialisation systems.

*For further information, see also:*
- Area 1: frames of responsibility 1, 3
- Area 2: frame of responsibility 8
- Area 3: frames of responsibility 11, 13, 15, 17
Area 6: frames of responsibility 30, 33
Area 8: frames of responsibility 40, 41, 42, 43
SUMMARY

Area 5 - Innovation

Frame of responsibility 23:
Technology and knowledge brokering

Practical Options

PO94: INVOLVING THE BEARERS OF LOCAL KNOWLEDGE IN THE IDENTIFICATION OF APPROPRIATE TECHNOLOGIES
PO95: FOSTERING INNOVATIVE AND GOOD PRACTICES
PO96: EXPANDING THE USE OF PILOT PROGRAMMES
PO97: ESTABLISHING SCIENCE AND TECHNOLOGY PARKS TO PROMOTE COLLABORATION BETWEEN ACADEMIA AND BUSINESS
PO98: DISSEMINATING INFORMATION ON POSITIVE EXPERIENCES IN TECHNOLOGICAL DEVELOPMENT AT THE NATIONAL AND LOCAL LEVEL
PO99: ENCOURAGING EXCHANGES AMONG THE BENEFICIARIES OF DIFFERENT TECHNOLOGIES
PO100: USING MASS MEDIA AND THE INTERNET TO SPREAD APPROPRIATE TECHNOLOGIES
PO101: ENHANCING NETWORKING WITH SCIENTIFIC AND TECHNOLOGICAL DIASPORAS

Frame of responsibility 24:
Coping with technological plurality

Practical Options

PO102: PROVIDING AND EVALUATING TECHNOLOGICAL OPTIONS MAPS
PO103: IDENTIFYING AND PROMOTING “DEMAND SIDE” RATHER THAN “SUPPLY SIDE” TECHNOLOGIES
PO104: INVOLVING LOCAL SOCIAL ACTORS IN INNOVATION PROGRAMS
PO105: SETTING UP “LEARNING ALLIANCES” WITH THE PARTICIPATION OF PUBLIC AND PRIVATE ACTORS, RESEARCHERS, AND CIVIL SOCIETY
PO106: ASSURING RESPECT FOR LOCAL CULTURES IN PROMOTING AND REGULATING NEW TECHNOLOGIES
PO107: MAKING USE OF LOCAL MATERIALS WHENEVER POSSIBLE

Frame of responsibility 25:
Attitude of research institutes to innovation

Practical Options

PO108: CREATING MARKET ORIENTED RESEARCH AND EDUCATIONAL INSTITUTIONS, CENTRES AND NETWORKS
PO109: UPDATING ACADEMIC CURRICULA BY INTRODUCING THE ISSUES OF INNOVATION AND APPROPRIATE TECHNOLOGIES
PO110: INTRODUCING PROGRAMMES THAT MOTIVATE RESEARCHERS TO DEVELOP INTEREST IN INNOVATION ISSUES
PO111: PROMOTING EXCHANGES BETWEEN RESEARCHERS AND REPRESENTATIVES OF THE PRODUCTIVE WORLD
Frame of responsibility 26:
Attitude of enterprises to innovation

Practical Options
PO112: SUPPORTING PRIVATE ACTORS IN PROMOTING RESEARCH
PO113: SUPPORTING PRIVATE ACTORS IN IDENTIFYING RESEARCH NEEDS
PO114: PROMOTING TRAINING IN SMALL AND MEDIUM-SIZED ENTERPRISES

Frame of responsibility 27:
Promoting a research-based environment for innovation

Practical Options
PO115: SUPPORTING THE UP-SCALING OF POSITIVE LOCAL EXPERIENCES IN THE FIELD OF INNOVATION
PO116: IDENTIFYING AND AMENDING BUREAUCRATIC MECHANISMS WHICH MAKE INNOVATION MORE PROBLEMATIC
PO117: CREATING AND PROMOTING INFORMATION AND CONSULTANCY SERVICES
PO118: PROMOTING SERVICES THAT FACILITATE NETWORKING AMONG ACTORS INTERESTED IN INNOVATION ISSUES
PO119: PROMOTING PARTNERSHIPS BETWEEN UNIVERSITIES AND ENTERPRISES
PO120: INFORMATION AND AWARENESS BUILDING ON TERRITORIAL INNOVATION

Frame of responsibility 28:
Juridically and financially enabling environment for innovation

Practical Options
PO121: STRENGTHENING GOVERNMENT COORDINATION STRUCTURES IN THE FIELD OF INNOVATION
PO122: CREATING FURTHER OPPORTUNITIES FOR PUBLIC AND PRIVATE FUNDING OF INNOVATION
PO123: SUPPORTING A STRONGER ENGAGEMENT OF CREDIT FINANCIAL INSTITUTIONS IN THE INNOVATION FIELD
PO124: INTRODUCING FISCAL INCENTIVES FOR COMPANIES PERFORMING R&D
PO125: PROVIDING FINANCIAL SUPPORT TO TECHNOLOGIES THAT CAN PREVENT NEGATIVE SOCIAL AND ENVIRONMENTAL IMPACTS
PO126: ENHANCING THE PROTECTION OF INTELLECTUAL PROPERTY RIGHTS

Frame of responsibility 29:
Innovative spirit in the population

Practical Options
PO127: PROMOTING AWARENESS-RAISING INITIATIVES ON INNOVATION AS A TOOL TO SOLVE SOCIAL AND ECONOMIC PROBLEMS
PO128: TRUST BUILDING ACTIVITIES WITH LOCAL PEOPLE ON INNOVATION ISSUES
PO129: PROMPTING “LAB-WORK” AT SEVERAL LEVELS

Lessons learnt Kenya
- Identifying the economic benefits of new technologies will facilitate their take-up
• There is scope for building partnerships between the STR community and the informal business sector

Lessons learnt India

• Establish better linkages between the world of research and the world of production in specific sectors at any level
• Enhancing research and experimentation on sustainable technologies.
• Involve and build the trust of local social actors in the innovation programs
• Foster innovative and good practices of extension services
• Sensitise and support small and medium-sized enterprises in promoting research.
• Enhance and strengthen the process of facilitating the patenting process.
• Create opportunities for public and private funding of innovation initiatives.
Chapter Six
Area 6
Governance

In the new context of STR-Society relationships, governance processes assume an ever greater importance as regarding the possibility to avoid the “technological drift” (i.e. a progressive detachment of research and innovation from society) and lead STR towards common interest objectives.

In this context governance includes not only the management of relations with political institutions, engaging all the actors that in a direct or indirect way could exercise power over STR, but also the launching of initiatives that involve civil society in making choices about science and technology.

In the framework of SET-DEV issues, risks and opportunities related to governance are strongly emphasised in the two “Manifestos” (see the box). The Indian Manifesto on Science and Technology underscores the need for a dialogue and full participation of various stakeholders in the STR policy making on the basis of the acknowledgement of the will and capacity of all citizens to contribute in the debate on S&T. The Africa Manifesto for Science, Technology & Innovation proposes to train new African leadership in support of science, technology and innovation and suggests to speak no longer of a Triple Helix, but of a Quadruple Helix, fully including civil society.

The area of governance is certainly among those where actions and power of various players interact and often clash to make devising policies and actions in support of STR extremely fluid and difficult. SET-DEV has identifies the following issues: insufficient diffusion of a scientific culture among decision makers; the way decision power on STR is distributed between the various actors; the place of STR in the political agenda; the criteria for setting research priorities; the identification of development priorities; the linkages between research and other policy sectors (i.e. agriculture, health, environment, local development, etc.); funding decisions; the mobilisation of resources from a variety of sources; the participation of stakeholders and local communities in policy setting and implementation; the appropriate control on international interferences on local processes; policy implementation and monitoring; the prevention and repression of corruption in the political decision making processes related to STR; the support to the assumption of an active role by new actors, as those involved with the “Diaspora”, and others.

In these Guidelines we do not deal with the substantive aspects of governance or the research policies in specific sectors. We limit ourselves to provide, on the basis of concrete cases, some recommendations regarding approaches, methods and procedures appropriate for the governance of STR, both during the designing and at the implementation stages. In this sense, some frames of responsibility emerge as particularly important. As those presented previously, these frames of responsibility refer to some sets of risks that all the players involved with STR (with the exception of nobody) are asked to cope with and manage. These frames of responsibility concern:
quality of policy setting;
dialogue and participation in policy making;
policies implementation;
participative structures for stakeholders at local level;
financial resources and infrastructures for the research.

**FOR AN AFRICAN AGENDA ON RESEARCH AND INNOVATION**

...(Some present) “political statements are anchored in decades of attempts by the African governments to turn around its development fortunes through efforts to mainstream STI in Africa’s development policies and actions. Some of these include: the Monrovia Strategy (1979); the Lagos Plan of Action, (1980); the Abuja treaty (1991); and most recently, the adoption of Africa’s Science and Technology Consolidated Plan of Action (CPA) by the African Union in January 2007. The past two decades have also seen the formation of dedicated S&T Ministries, National Commissions, National Councils, and State Agencies as well as pan-African Governmental and Non-Governmental Institutions committed to STI capacity building and policy making in Africa."

...(…) “The Manifesto believes that by harnessing STI, African countries have a greater chance of addressing poverty, diseases and environmental destruction efficiently and sustainably. It provides a shared vision of a world in which the unheard voices; marginalized majority and the marginalized cultures and traditions of STI in Africa can be mobilized for African development. It is a call for diverse and fairly distributed forms of STI as a valid and timely way to embed STI in African societies. This is a shift towards greater respect for cultural variety, regional diversity, and democratic accountability in STI governance in Africa. To achieve this vision would require transformational changes in the current global STI agenda, the social inequity it creates, and the knowledge dependence that has informed and shaped Africa’s exclusion in the global STI development.”

...(…) “we must reject the idea that existing international division of labour in science is adequate for development. African governments and their development partners must embrace a culture of supporting, nurturing, celebrating and sustaining African science, technology and innovations that are fully embedded in African societies. Amongst other things, Africa must build her own critical mass of indigenous scientific, technological and innovative capacity. African science and technology must be driven by the needs of the African peoples. Institutional and policy reforms will be required to achieve this.”

...(…) “While Africa cannot stay reclusive of the globalised world, she needs to re-think the rules of her engagement in the global community. There is need for transformational and visionary leadership to harness the wealth of scientific and technological knowledge and skill base in the west while encouraging indigenous skill development and capacity building on the continent, guided by the socio-cultural, economic, environmental and political realities of Africa.”

From The African Manifesto for Science, Technology and Innovation
NEW INSTITUTIONAL FRAMEWORKS TO MAKE SCIENCE AND TECHNOLOGY RELEVANT TO INDIA

(…) The different forms of expertise affect all stages of scientific and technological development. This is evident and already discussed in the stages of production, implementation and evaluation of scientific and technological knowledge and design.

But an earlier stage is at least as important: the stage of problem definition. A problem is not intrinsically and a priori technical or economic or scientific or political. During the stage of problem definition the problem is given its key characteristics, depending on how the relevant forms of expertise play out. And once a problem has received its main characteristics, these will also determine which kinds of expertise can claim to contribute. Examples abound of how civil society groups have reconstituted expertise and continue to offer informed choices to communities in areas such as sustainable agriculture, water and energy.” (…)

(…) “Recognizing not only the existence of a broad spectrum of expertise, as well as the increasing relation between science, violence and inequity, raises the next question on the societal arrangements needed to make science and technology more relevant for the development of India. How does the ownership and management of resources relate to commercial markets and how does one establish democratic governance? To secure a balanced and adequate input of all relevant forms of expertise, what are the new regulatory frameworks that need to be developed that can challenge the retreat of the state in the current dominance of regulatory liberalism and market economy?. New institutional frameworks should better guarantee a balanced input of all forms of relevant expertise and reduce the gap caused by the retreat of the state and usurped by private corporations. (…)

From the Knowledge Swaraj: An Indian Manifesto on Science and Technology
FRAME OF RESPONSIBILITY 30
QUALITY OF POLICY SETTING

Rationale

SET-DEV experience shows that one of the most important parameters of the governance of STR is the quality of policy setting. A key component here is the participation of stakeholders to which the frames of responsibility that follow are specifically dedicated. But we must also consider other important aspects such as: various forms of foreign dependency in the governance of research (for example, in financial terms and in defining of agendas); prevalence of a market-driven approach prioritizing profit making (for example, since investment in the treatment of certain diseases does not produce significant profits, if neglected and the cost of medicine is often excessive); slow decision making as opposed to the ever faster pace of research; lack of attention to ethical issues in policy making; policy makers struggle to deal with complex situations (preferring simplistic interpretations and solutions, instead of the more articulated contributions of scientific research); policy makers are only interested in short-term results, neglecting long-term projects; lack of coordination in regulations; difficulties in effectively regulating key issues or new fields of technology (e.g. Internet); difficulties for policy makers to exchange information and knowledge, and more.

As we can see, rather than political measures on specific science and technology areas or sectors (not discussed here), this set of issues mainly concerns some pre-conditions that facilitate policy making, in terms of approach and method. To this end, different types of measures have been identified and implemented (SET-DEV countries including) concerning, for example, the coordination of STR policies, knowledge exchange and networking, monitoring and controlling the introduction of new technologies by foreign actors (e.g. biotechnology), and more. In any event, this is clearly an important frame of responsibility, concerning which a number of practical options are worth considering.

Practical Options

P0130: Promoting programs for sharing knowledge needed for policy setting

Knowledge sharing programs are a way of providing an adequate knowledge base for policy setting. These programs may include meetings to share information and experience between decision makers and other actors or between different public institutions operating in the field of STR. For example, in Kenya the strategic document "Vision 2030" is the result of consultation with different economic, social and research actors. Knowledge sharing may also involve collecting and analyzing studies and documents that relate to the governance of STR, which are often little known and under-used (see box). In India a number of
methodologies have been experimented to link research, experience and policy-making in the field of water management (see box).

"KENYA VISION 2030"

Kenya Vision 2030 is a business plan for a sustained long-term economic and social development, based on an extensive use of scientific and technological research. The plan, launched in 2006, is based on a structure of consultation with public, private and non-profit actors.

(from the initiative’s official website)

“To remain relevant and competitive regionally and globally, Kenya must plan for the future. It must chart a new road map - a road map that learns from our past failures, builds on our strengths and confronts the realities of poverty, unemployment and globalization. The need for a vision is, therefore, apparent. Kenya 2030 lays the foundation for an economic revolution for the present and future leadership.

Kenya could chart a path involving radical transformation. Through maximum exploitation of science, technology and innovation, we can initiate focused interventions targeting the elimination of absolute poverty; improvement of equity and access to social services; promotion of private sector development through a regulatory framework that reduces the cost of doing business; a sound legal system that protects property rights and effectively dispenses justice; all these underpinned by accountable leadership at all levels of government."


STR GOVERNANCE IN EPW ARTICLES

A study carried out by Payodhi Thapliyal, of the Xavier Institute of Management (Bhubaneswar), focused on the presence of the topics regarding the STR socialisation in the articles published from 2001 and 2008 on EPW (Economic and Political Weekly), an Indian social sciences journal. The study assumed the articulation of STR socialisation proposed by SET-DEV. From the study emerges that the topics regarding science governance are the most diffused ones (they have been founded in the 28% of published articles).

Thapliyal 2009
WASSAN: FROM RESEARCH TO POLICIES

Practices

In starting new programmes, the Indian NGO WASSAN (water and sanitation agency) introduced a new type of procedure to take advantage of new ideas and experiment pilot projects and innovation initiatives on the ground. Through the experience and involvement of different actors, a negotiation area is created among the various stakeholders.

The procedure adopted is cyclical. The cycle has 4 fundamental phases: 1) a mandate is given to a working group; 2) lessons from different experiences are consolidated by integrating various methods (from action research and literature review to holding workshops with stakeholders); 3) studies are converted into “policy guidelines”; 4) new programmes are developed. In both research and application an important element is the involvement of NGOs. A particularly important aspect in initiatives of this kind is also the drafting of intelligible study reports.

The procedure adopted by WASSAN in Andhra Pradesh, and can also be used by other organisations or groups of organisations. Similar procedures have been adopted successfully in other areas of India.

KICS 2007

PO131: Harmonising the policies and regulations on STR

An important factor affecting the quality of STR governance is the harmonisation of policies (especially government policies) and standards. This harmonisation aims at optimising the use of resources and reducing the risks of a proliferation and overlap of interventions, which can lead to confusion and uncertainty among the actors involved. In the case of India, for example, this function is carried out by the Department of Scientific and Industrial Research. Whereas in Kenya in 2008 the Ministry of Higher Education, Science and Technology (Modest) was created with an expanded mandate covering university education, technical education, continuing education and learning, and science, technology and innovation. Harmonisation of the work of different government agencies in this field is also carried out through the National Council for Science and Technology.

PO132: Taking measures to limit external interference in areas pertaining to national interests

To limit outside interference in national STR policies in terms of both funding and determining agendas a number of different measures can be implemented: increasing capacity for development and programming; implementing monitoring and enforcement mechanisms; clear regulations of involvement of foreign actors. An example of government supervision of the introduction of new technologies is the case of damages filed by the State of Andhra Pradesh (India) against Monsanto over the use of Bt cotton. These measures may also improve the channelling of outside financial and intellectual resources.

12 See Bhargava 2006.
**PO133: Assuring that policies make constant reference to well-established ethical principles for research**

Ethical principles of research are becoming increasingly important internationally. In the case of Europe, there are principles such as respect for human dignity, utility (or benefit), precaution, and justice (see: ftp://ftp.cordis.europa.eu/pub/fp7/docs/ethics-concepts.pdf). It is important to make sure that these and other principles are not only stated but also included in STR policy guidelines and implemented (see box).

**The European Commission and the Precautionary Principle: Guidelines**

The "precautionary principle" is used to implement precautionary behaviour in political and economic decisions for the management of controversial scientific issues, such as the environment or health (human and animal). This principle has gained in importance over the past two decades (particularly since the Rio Declaration of 1992) to guarantee development policies compatible with environmental protection. The European Commission has issued special guidelines and directives for the implementation of this principle, an excerpt of which is quoted below.

“The precautionary principle should be informed by three specific principles:

- implementation of the principle should be based on the fullest possible scientific evaluation. As far as possible this evaluation should determine the degree of scientific uncertainty at each stage;
- any decision to act or not to act pursuant to the precautionary principle must be preceded by a risk evaluation and an evaluation of the potential consequences of inaction;
- once the results of the scientific evaluation and/or the risk evaluation are available, all the interested parties must be given the opportunity to study of the various options available, while ensuring the greatest possible transparency.

Besides these specific principles, the general principles of good risk management remain applicable when the precautionary principle is invoked. These are the following five principles:

- proportionality between the measures taken and the chosen level of protection;
- non-discrimination in application of the measures;
- consistency of the measures with similar measures already taken in similar situations or using similar approaches;
- examination of the benefits and costs of action or lack of action;
- review of the measures in the light of scientific developments.

Apart from the rules applicable to products such as drugs, pesticides or food additives, Community legislation does not prescribe a prior authorisation system for placing products on the market. Thus in most cases it is for the users, the citizens or consumer associations to demonstrate the danger associated with a procedure or a product after it has been placed on the market.

According to the Commission, an action taken under the precautionary principle may in certain cases include a clause shifting the burden of proof to the producer, manufacturer or importer. This possibility should be examined on a case-by-case basis; the Commission does not recommend the general extension of such an obligation to all products.”

**PO134: Promoting exchanges and networking among decision-makers at the regional and international level on S&T policies**

It is particularly important to promote exchanges and networking among decision-makers at regional and international levels in order to develop new shared research and innovation strategies. A major role in promoting these exchanges can be played by international and non-governmental actors, as in some positive experiences carried out in Africa (see box).

**THE AFRICAN MINISTERIAL COUNCIL ON SCIENCE AND TECHNOLOGY (AMCOST) AND THE AFRICA’S SCIENCE AND TECHNOLOGY CONSOLIDATED PLAN OF ACTION (CPA)**

The African Ministerial Council on Science and Technology (AMCOST) was created in 2003 through a NEPAD initiative, as a place for policy elaboration and as a forum involving Science and Technology ministries of the African Union member countries. The goal of the forum is to facilitate the emergence of a leadership for backing the scientific and technological development in support of socio-economic growth in the region. AMCOST promotes international and regional cooperation projects and programmes, aimed at: increasing availability of research infrastructures; setting of international agreements for mobilizing new resources for innovation; strengthening of human resources in S&T; building a strong consensus among politicians and civil societies about science; sharing of experiences; strengthening the capacity of regional economic bodies to mainstream science and technology into their sectoral programmes and projects; applying science and technology for achieving the MDGs; promoting innovative ways and means to finance science and technology in Africa. To achieve its objectives, AMCOST developed and adopted the “Africa's Science and Technology Consolidated Plan of Action” (CPA), a pan-African plan for boosting S&T.

http://www.nepadst.org/

**PO135: Assigning a proper role to social sciences in STR management and governance**

These guidelines are based on the recognition of the inherently social nature of scientific and technological research. Hence, the social sciences can make an important contribution to STR governance by creating new and wider perspectives for the study of the relationship between science and society, identifying the problem areas in this relationship and suggesting solutions and strategies for policy-making. It is, therefore, important to include the contribution of social scientists in the design, development, testing and evaluation of STR policies. This contribution can be made by participating in committees and think tanks, organizing seminars and workshops, carrying out feasibility studies and evaluation, and more (for more details, see Bijker, d'Andrea 2009).

**PO136: Creating authorities on key policy issues**

The accelerating speed and complexity of technological change makes it increasingly difficult to identify appropriate forms of regulation and control. An important tool to address this problem is the establishment of authorities, or institutions to address some key issues, through monitoring, supervision, coordination and regulatory proposals. In the following two boxes some considerations on the governance of STR based on a set of initiatives promoted under SET-DEV are reported below.
THE LEGAL DIMENSION OF SCIENCE, TECHNOLOGY & INNOVATION POLICY

The role of law as an instrument of policy is often taken for granted with the result that insufficient resources, time or preparation are allocated to the regulatory regime which would permit a successful Science, Technology & Innovation policy to flourish. The law may be used in a number of ways:

- To provide the right competitive environment which is conducive to industrial investment and development in STI;
- To provide safeguards for the vast majority of citizens affected by the impact of STI on everyday life;
- To promote and protect the individual and collective interests of members of minority groups whose culture forms an unique part of the fabric of a given society;
- To be a primary tool of Business Process re-engineering in any given part of a social context including STI.

The potential social impacts of a successful Science, Technology & Innovation policy extend from creativity in investment opportunities to preservation and promotion of cultural identity. It may be useful for emerging economies to set up Technology Law Council or a Technology Law Institute bringing together Technology lawyers from leading local Universities possibly with a presence from one or more European Technology Law Institutes. These may possibly help leapfrog legislative and policy-making problems which many EU countries have already experienced and may achieve a more holistic approach to technology law while maintaining a detailed insight into the special issues raised by indigenous peoples.

Excerpts from SET-DEV WP9 draft documents

NATIONAL INFORMATION SOCIETY COUNCILS/INSTITUTES

In many emerging economies many indigenous peoples are essentially dwindling minorities at risk of assimilation or extinction especially insofar as language and diverse cultural elements are concerned. The risks faced by indigenous peoples in emerging economies are not dissimilar to those faced by many minorities across Europe especially those to be found in rural areas. If new technologies can be used in emerging economies to bridge the urban/rural divide and or preserve and promote cultural attributes they can be likewise used in Europe for the same purpose. Whether it is so-called Saxon communities in Romania (a dwindling minority) or Asian-origin minorities in the UK (growing minorities) issues such as assimilation, language, tradition, family and other values may be promoted, preserved or put at risk by new technologies such as the Internet, mobile telephony etc. At this moment in time most EU countries do not have a comprehensive and systemic approach to measuring, channelling, arresting or promoting the impact of new technologies on society and especially on the various and many minorities within such societies. There are a number of sporadic approaches to such issues but on the whole it is fair to say that such impact assessment and related policies in the information society are fragmentary and that this fragmentation does not facilitate the optimal use of resources available. Thus, the idea of an effective Technology (or Information Society) Council with as wide a remit as that recommended for emerging economies (i.e. sociological, legal and anthropological as well as economical/technical) with a special and explicit focus on the needs of minorities would be a useful state-sponsored initiative in those EU countries where it does not yet currently exist.

A number of SET-DEV members are participating in the LexConverge network wherein they are promoting a number of relevant research projects across Europe taking advantage of EU FP7 funding. While these projects are doubtless very valuable their impact would be
enhanced further by the existence of national Information Society Councils or Institutes who would then be able to translate the findings and recommendations of empirical research into concrete policies.

Excerpts from SET-DEV WP9 draft documents

**P0137: Filling the gaps in scientific personnel for specific key roles or sectors**

Focusing on human resources in research is a key aspect in setting STR policies. As suggested in some meetings organised by SET-DEV in Kenya, it is crucial to fill possible gaps and imbalances in key scientific personnel for specific research roles or sectors. This may require, among other things, constant statistical updates of research staff (universities, laboratories and research centres, etc); programming university courses for researchers in key areas; selection of scientific staff to be employed in research organisations.
The central role of STR in social and economic life increasingly requires the adoption of **responsible and shared policies**. The risk is that research is governed by technocratic criteria unrelated to the needs of society and dependent on choices made by foreign political and economic actors without or little consideration of the interests of local communities. Thus, it is crucial for the process of STR policy making to **involve** such stakeholders as politicians, producers of scientific knowledge, experts, interest groups, decision makers, international organisations, research institutes, business associations, civil society organisations. Under these circumstances the so-called "Triple Helix" model is proving increasingly inadequate: STR stakeholders are not just politicians, scientists or entrepreneurs, but also citizens' organisations, who want a more public and participatory debate on priorities in science and technology.

Under SET-DEV, the theme of dialogue and participation in STR policy makes a main component of the **Indian Manifesto** on Science and Technology, which emphasises the need to give citizens full ownership and enable them to contribute with their knowledge to the debate on S&T. The **Africa Manifesto** for Science, Technology & Innovation also highlights the importance of promoting and supporting a new, participatory governance that gives a prominent role to national and local stakeholders, as well as pan-African and international actors. In addition, the Manifesto suggests that we should speak not of a triple but a "quadruple helix", including the civil society.

Awareness of the need for a **dialogue** with and the **participation** of different stakeholders in STR policy has been gaining momentum, but there are still many **unanswered questions** and obstacles along the road such as **top-down approach** in policy development; **lack of knowledge** of social and economic actors interested in STR; **unwillingness** of decision makers to effectively involve stakeholders; **lack of dialogue between policy makers and researchers at the local level; use of “blanket solutions”**, i.e. policies and actions that cover the whole country indiscriminately with no reference to local specificities; difficulties in carrying out a public and shared review of priorities and agendas in some areas of research (e.g. biotechnology and nuclear energy), and more.

Dialogue and participation **models can be very different** depending on the context and choices about "who decides" and "how". The fact remains that a dialogue and participation in policy making in this field is an important frame of responsibility for STR actors. In this regard, a number of **practical options** can be mentioned.
**PRACTICAL OPTIONS**

**PO138: Encouraging broader participation in STR in sectors not yet sufficiently open to the public**

As SET-DEV initiatives in India and Kenya have demonstrated, it is important to encourage broad participation of stakeholders in the debate about the purposes, risks and opportunities of technology in some key areas of research. These areas may include, for example, nuclear energy or the applications of space research and biotechnology. To promote community debate and review of technology policies in these areas, various tools can be used including information campaigns in local and national media about policies in a given field or a specific technology; seminars to increase awareness of specific targets (e.g. local government, civil society organisations, businessmen, etc); creation of networks and interest groups; portals and websites to discuss technological options; roundtables between policy makers, researchers and stakeholders to examine and evaluate policies, etc.

**PO139: Promoting and disseminating national and local maps of STR actors**

To identify the actors that should be involved in STR policy discussions a particularly useful tool is the mapping of relevant social groups and stakeholders. These are groups that have knowledge, expertise and attitudes that can help to define research agendas and identify the possible impacts of technology. The SET-DEV initiative on climate highlighted the importance of mapping the actors and the institutional relations between research professionals, civil society, and the state, to enable communities to understand their situation and express their concerns, aspirations and entitlements in the debate on climate at international and local level. Some suggestions on the mapping of the actors are shown in the box below.

**Mapping of local actors**

“An actor-oriented approach primarily focuses on mapping the relationship and flow of information among various actors in a system to facilitate reflection and action. (...)” ‘Stakeholder analysis can be defined as an approach for understanding a system by identifying the key actors or stakeholders in the system, and assessing their respective interest in that system’ (Grimble et al. 1995). Grimble and Wellard (1996) underline the usefulness of stakeholder analysis in understanding complexity and compatibility problems between objectives and stakeholders. In case of policy studies stakeholder analysis particularly helps in assessing how people affect policies and institutions, and how policies and institutions affect people. A number of analysts in the field call for the introduction of participatory and deliberative processes as a mechanism to guide strengthening of the science-policy interface. These involve bringing together key stakeholders so as to combine different types of evidence, to incorporate diverse opinions and to ground decisions in relevant, feasible and implementable advice (Jones et al. 2008). If the policies and institutions are geared towards improving livelihoods then understanding the individuals and groups that affect them, or are affected by them, is crucial at all levels (Mayers, 2005). Moreover, the range of stakeholders and their roles are dynamic, so one has to see beyond the superficial roles of the actors. A list of stakeholders associated with agriculture policy is generated. The stakeholders are then classified institution-wise. In this study, the stakeholders are mapped as per their affiliation to the in-

---

13 See Mendoza, Dsouza 2010.
Involving scientific communities in setting policies at local level

It is important to involve scientific communities at the local level in STR policy setting. These communities possess sensibilities, information and valuable knowledge closely connected to the areas in which they live and own practical needs. To this end, useful tools are seminars and conferences at universities or at university departments, focus groups on specific subjects, distance consultation via the Internet. These recommendations emerged in several SET-DEV meetings, particularly at the seminar “Climate Change – a Glocal Approach: Democratizing the Science and Technology of Climate Change” organised by Centre for Education and Documentation in Bengaluru on February 23rd 2010. The involvement of local scientific communities, in this case, is essential, since a large body of knowledge that they have accumulated on localised impacts of climate change remain generally ignored.

Promoting the involvement of private actors in S&T

In addition to what has already been discussed with respect to innovation (see Area 5), it is essential to involve private stakeholders also in the governance of science and technology. This may include, for example, working committees to develop national state and local STR development plans; mixed public-private projects to boost technological research (for example, to create or strengthen technology districts); working groups to discuss regulation (technological research, the relationship between universities and enterprises, research funds, etc); conferences on corporate social responsibility in STR, at national and local levels, and more.

Involvement of private actors in biotechnology

An example of a partnership between government and business is the one set up in the field of biotechnology between the government of Andhra Pradesh and some Indian and Asian business organisations (NASSCOM, AIBA, ABLE), so as to develop this sector in this Indian state. The government acted as facilitator and provided funds.

Involving new generations of young researchers in S&T decision making

Governance of STR socialisation should also involve new generations of researchers in decision making. This involvement can take place in different ways, such as: conferences and seminars between decision makers and young researchers or inventors; decentralised
consultation with young researchers on key issues of science and technology; setting up young researcher lobbies and networks at national and transnational levels, in the wake of experiences such as the African Youth Forum on Science and Technology (AYFST), promoted by ATPS, a SET-DEV partner (see also Area 1).

**PO143: Enhancing the role of young civil servants who are interested in S&T issues**

SET-DEV studies in India and Kenya show that young civil servants are usually more interested in S&T issues than their older colleagues and thus can help bring together decision makers and other social and economic actors at both national and local levels. The following actions can be taken to support this role: setting up mediation offices (for example in ministries concerned with S&T); assigning high-responsibility tasks to young officers to facilitate dialogue between government and social or business organisations; seminars and S&T training courses for young civil servants (in ministries or local governments); setting up networks of young civil servants to exchange information and experiences about stakeholder dialogue and participation in S&T.

**PO144: Involving civil society organisations in decision making**

Civil society organisations should be involved in decision making at various levels of STR. These organisations often represent the marginalised segments of the population, who are more likely to suffer the negative impacts of inappropriate technologies imposed from the top. For example, these actors can participate in seminars, working groups and roundtables at national and local levels on technological options in the sectors that affect them most (agriculture, energy, health, water management, etc). In the case of specific projects to develop and transfer technology, meetings, advisory boards, opinion polls can be set up.

**WORKSHOPS ON POLICY MAKING**

As a forum, the Centre for World Solidarity (CWS) - Knowledge in Civil Society (KICS) promotes in India workshops on contemporary public policy issues that impinge on peoples’ lives, such as the national workshop on “Policy Matters: Insights from Civil Society engaging with S&T” held in August 2007. Themes discussed included: civil society and the policy environment; civil society experiences with policy making; institutional change and civil society; science and democracy.

The transition from STR policy development to implementation is a particularly delicate operation. In this phase, in fact, the actors responsible for these policies may come up against many obstacles, which can lead to inappropriate or incomplete implementation or even no implementation at all.

SET-DEV identified various obstacles to the implementation of STR policies, for example: lack of monitoring and control bodies; lack of financial and organisational resources; widespread political corruption (especially at local level); lack of stakeholder and local community participation in policy implementation; difficulties predicting policy impacts; difficulties in tackling unexpected crises and emergencies; lack of certification tools for the outcomes of certain policies.

As demonstrated by some significant case studies investigated in the framework of SET-DEV, policy implementation in the field of STR can and must become a collective endeavour, in which all social actors have a say and play an active and creative role. Concerning this frame of responsibility, the following practical options can be suggested.

**PRACTICAL OPTIONS**

**PO145: Encouraging the implementation of regional strategies**

A driving force for S&T and its relationship with society's needs at the level of nation-states is the implementation of regional strategies. In the case of Africa, for example, mention can be made of the 2005 NEPAD action plan and the 2006 African Ministerial Council on Science and Technology (AMCOST) (see box).

**THE 2006 CAIRO CONFERENCE**

The African Ministerial Council on Science and Technology (AMCOST) held its Extraordinary Conference in Cairo, Egypt from 20-24 November 2006. Organised by the African Union (AU) Commission and hosted by the Government of Egypt, the conference opened with an experts meeting from 20-22 November, followed by a ministerial meeting from 23-24 November. It was attended by representatives from 26 AU member states and agencies, international and continental government and non-governmental organisations (NGOs), and the Diaspora.

Delegates considered a range of proposals and reports on African science and technology matters. These included: a proposal to establish an African Presidents’ Committee for Science and Technology; the draft report of the High-level Panel on Modern Biotechnology; the
P0146: **Fostering cooperation among different projects in the same area**

Apart from coordinating government policies in the centre, local level cooperation is also important for projects implementing STR policies. As cases studied by SET-DEV demonstrate such cooperation can be achieved though initiatives taken by government actors, the civil society or international cooperation, using instruments such as: information seminars, coordination groups, observatories, and more.

P0147: **Creating partnerships to cope with crises or emergencies**

To use technology to tackle crisis or disaster situations of different kinds (e.g., natural disasters, health emergencies, crises in the agricultural field, etc), it is important to create local partnerships with public, private, civil society and, where present, international actors. As shown by numerous examples in India (see box), these partnerships can help detect existing needs, share experiences and knowledge, and identify the most appropriate technological solutions.
CRISIS MANAGEMENT: A PUBLIC - PRIVATE INITIATIVE FOR THE FIGHT AGAINST THE “TOBACCO STREAK VIRUS”

Practices

An interesting partnership that was set up to tackle an agricultural crisis was the ABSP II project in India (Andhra Pradesh) for the period 2004-2009. The project was funded by USAID and implemented in partnership with the ICAR-National Bureau of Plant Genetic Research, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Sathguru Management Consultants, Acharya NG Ranga Agricultural University (ANGRAU).

In India, approximately 9 million small farmers depend on the cultivation of groundnuts, grown on a total of 7.5 million hectares of land and with an annual production of 8 million tons. Starting in 2000, the groundnuts were affected by the spread of the Tobacco Streak Virus (TSV), an infection that has profoundly influenced the lives of small farmers, halving their income. Thanks to the concerted action of private organisations and a consortium of public institutions, the Crop Protein (CP) gene patent was obtained on favourable terms from Monsanto to develop a calibrated version of the TSV Virus and give the license (non-exclusive) to ICRISAT and ANGRAU to develop a groundnut resistant to the virus and free from royalties. Efforts are directed at developing a variety of groundnut resistant to TSV that can be marketed at affordable prices by 2009. This action could lead to the production of a high quality groundnut at controlled prices, fewer losses of nuts due to TSV, cost savings in the protection of nuts, increased income and food security for small scale farmers, and continued research on the groundnut.

www.absp2.cornell.edu/

PO148: Implementing preventive management of the social, economic and environmental impacts of technological decisions

To avoid as much as possible the implementation of technological policies that have a negative impact on the population, it is essential to guarantee preventive management of the social, economic, and environmental impacts of technology. To this end, in Europe, India and Africa, a variety of instruments have been developed including, inter alia: impact assessments; consultation forums with representatives of citizens from certain areas (e.g. in the case of interventions in agriculture, environment, etc); monitoring and forecasting activities with the involvement of multidisciplinary experts, and more.

PO149: Adopting certification systems at the local level

Adopting certification systems can be an important tool to ensure the proper implementation of policies and regulations dealing with specific technological solutions, also at the local level. For example, during the SET-DEV seminar on climate change held in Bengaluru in February 2010, a Carbon Emission Reduction Certificate was described, applicable at village level, as part of a broader plan to reduce the use of coal. At the same time, such initiatives can function as pilot activities to promote environmental policies in the area.

PO150: Promoting monitoring structures to foster transparency in S&T policies implementation

The common experience of SET-DEV countries shows that effective policy implementation in the field of S&T, especially as regards allowance and fund management, requires appropriate monitoring facilities both at the central and decentralised government level (state,
region, province, etc). These structures should be provided with qualified human resources, as well as organisational, logistics and financial resources. These structures should ensure, at all levels, the participation of non-state actors (especially the research community and civil society) through the joint development of indicators for monitoring and regular verifications.

**P0151: Introducing capacity building programs for civil servants in charge of coordinating S&T policies**

To support civil servants in charge of coordinating S&T policies at the central and decentralised government level, specific capacity building programs can be organised that focus on the following issues: the relationship between S&T policy development and implementation; obstacles and enablers in implementing these policies; consultation and participation of local and international actors; monitoring and evaluation of policy implementation, etc.
FRAME OF RESPONSIBILITY 33

PARTICIPATIVE STRUCTURES FOR STAKEHOLDERS AT LOCAL LEVEL

- **RATIONALE**

The principle that community participation is vital in science and technology dissemination is not yet widely accepted (see Frame No 33). But even when this principle is recognised, it is by no means certain that it is translated into specific methods and practices at the local level.

In fact, the experimental and research activities carried out under SET-DEV in India and Kenya have highlighted difficulties and unanswered questions. They include lack of established reference models and organisational structures for the participation of local stakeholders; lack of dialogue or even the presence of conflict among local stakeholders (research, private, civil society, etc); the unwillingness of decision makers to contact civil society organisations; the difficult dialogue between decision makers and the poor; the low involvement of women, or traditional leaders and religious figures in decision-making.

At the same time, SET-DEV identified and studied a number of significant examples of stakeholder participation not only in the application and dissemination of technologies, but also in fine-tuning technological solutions (e.g. to problems in agriculture or water management) that are most appropriate for local needs.

An important frame of responsibility in the field of STR governance concerns, therefore, the creation of appropriate structures for participation of local stakeholders to facilitate relevant and shared decisions on how to set up STR, and then manage its social and economic impact. To this end, the following 7 practical options can be identified.

- **PRACTICAL OPTIONS**

**P0152: Experimenting with new forms of consultation and consensus building among beneficiaries**

The beneficiaries of projects that employ new technologies are often poorly informed and little involved, and their existing needs and cultural and social specificities are not taken into due consideration. Identifying appropriate forms of consultation with stakeholders and consensus building is, therefore, important in the governance of STR at the local level. The search for solutions to this problem may even lead to institutional building of some sort, or the creation of new participatory bodies and structures (see box).
**Dialogue and Consensus Building in the Field of Forestry Technology**

**Practices**

After a long period characterised by difficult relations and the first round of consultation at the beginning of the last decade, the relationship between the Andhra Pradesh Government Forest Department (FD) and NGOs has, since 2005, become one of constructive criticism. In this phase, the FD asked the NGOs to formulate sustainable development practices that could be promoted in a project financed by World Bank. Thus a relationship of stability and mutual trust was established between the NGOs and the Forest Department. The following contributed to establishing this relationship:

- Organisation of meetings in which all relevant projects could participate effectively;
- Illustration and explanation of different points of view;
- Integration of formal and informal interactions;
- The Forest Department’s willingness to accept information from external parties and to disseminate this information, even when in contrast to the FD’s original point of view;
- WB’s role of catalyst and stimulus;
- Monitoring mechanisms that enabled different positions to be considered;
- The inclusion of the elements that gradually emerged from consultation in the planning of subsequent stages.

KICS, 2007

**The Participation of Stakeholders in Rural Projects**

**Practices**

By means of the National Agricultural Livestock Extension Programme (NALEP), the Kenya Ministry of Agriculture (MoA) has adopted a participatory methodology of extension. The approach adopted envisages the direct involvement of the various actors starting from the planning stage, to identify the development problems of a specific area of interest. In this regard, the MoA has a facilitating role geared to promoting a holistic approach to the problems and encouraging the various actors to make their specific contribution. Through the meetings organised by the MoA within the NALEP, the local actors and communities come into contact with services that would otherwise be hardly reachable and can inform them of their needs.

Carrying out the NALEP meant setting up over 7,000 community interest groups, involving over 150,000 people. In many cases, these groups tend to promote new ideas, both within NALEP meetings and with respect to the communities they belong to.

Cuellar M. et al. 2006

**PO153: Creation of local networks and partnerships**

Particularly important participatory structures are networks, effective structures for dialogue and coordination, which, even at local level, can facilitate exchange of experiences and information among actors that frequently do not communicate (local governments, professionals, companies, NGOs, beneficiaries, etc). In some cases, these networks are consolidated into partnerships and alliances with their own structures and regulations, as in the case of "learning alliances" mentioned in the area of Innovation.
**PO154: Promoting project commitment and project ownership among local stakeholders**

It is important for stakeholders to develop a sense of ownership as regards STR projects. The involvement of end-users in all phases of the project (see box) and direct communication among stakeholders are of particular importance. Moreover, in the case of Egerton University (Kenya), many research programs are developed with the approval of stakeholders to increase ownership and improve response to local needs and priorities.

“Scientific research and continuous sharing of knowledge with farmers have permitted ICIPE to develop a real ‘cultural grounded technology’, which has consequently been adopted very easily by the end users. The end-users have been involved in all research stages and contributed to the fine-tuning of the technology once it was brought from trials to fields. ICIPE also encourages farmers to first understand the technology and then invest in it”.

Part of an interview with representatives of ICIPE (Kenya), October 2009 (see: African Manifesto for Science, Technology & Innovation, draft May 2010; Amudavi et al 2009; interviews at ICIPE, October 2009; interviews at Egerton University, October 2009)

**PO155: Encouraging the involvement of local political, traditional and religious leaders**

To ensure that participatory processes are relevant and effective it is important to involve key players that have an important political, symbolic and moral role. For example, an ICIPE project fighting crop pests in parts of Kenya involved active participation of not only local government officials, but also traditional chiefs and religious leaders in the preparation and convening of awareness meetings with farmers.

**PO156: Promoting the involvement of local women-leaders**

It is now widely accepted that without the participation of women it is not possible to guarantee success of programs in such fields as the development of appropriate technologies (see box). In particular, involvement of local women leaders, such as presidents of cooperatives and women's associations, is crucial.

“Women are main the ones who are responsible for agriculture activities so they are encouraged to participate in field days. It has been established that the women are the one are more able to influence other women and the ‘rate of diffusion’ is much more with women”.

From interviews with representatives of ICIPE (Kenya), October 2009

**PO157: Supporting the empowerment of civil society organisations in the field of S&T**

The participation of civil society organisations in STR projects and initiatives at the local level can also be an important opportunity for empowering these organisations so that they can have more say in the governance of STR at local level. This empowerment can be supported by interventions such as offering guidance, advice and training (see box).
SELF-ORGANISATION OF CITIZENS IN WATER MANAGEMENT

Practices

In the Indian state of Tamil Nadu, the NGO GUIDE supported a number of citizens’ self-organisation initiatives for the management of water resources in the river Palar basin and the selection of appropriate technologies. These included the "Resource Protection Committees" and "Water Parliament". In particular, the Water Parliaments are made up of students, members of other NGOs, villagers, panchayat presidents, leaders of farmers and others who use this open platform to join together in the name of protecting local water resources.

Source: Hoering, 2008
http://indiawaterportal.org/sites/indiawaterportal.org/files/Water_to_the_People_EED_CWS_April%202008.pdf

PO158: Promoting conflict resolution at the local level

In projects that involve new technologies conflicts of interests at the local level are not infrequent. For this reason, conflict resolution techniques to receive growing attention in developing countries. One example is "multi-stakeholder dialogues" tested in India for resolving conflicts over water management. These involve setting up roundtables that bring conflicting parties together with the objective of finding solutions acceptable to a wide group of stakeholders (see: Hoering 2008; Janakarajan, no date).
Scientific and technological research is now at risk in many parts of the planet due to a lack of financial resources and infrastructure. Often, in a simplistic manner finances and infrastructure are seen as the only factor behind the success of a national research system. In reality, as suggested in these guidelines, other factors may be equally important. However, research funding and adequate infrastructure are necessary (though not sufficient) conditions for successful scientific and innovation activities.

SET-DEV has revealed numerous problems related to financing and infrastructure, the seriousness of which varies, of course, depending on the context. As for funding, problems in question include inadequacy of public funding for university education and research; failure to distinguish between research and education in national budgets (which leads to confusion and imbalances in the allocation of funds); lack of private funding for basic research (due to a preference for solutions developed elsewhere); lack of investment in research to find solutions to socio-economic problems (e.g. in agriculture, medicine, etc.); slow and cumbersome funding procedures for universities, which make it difficult to implement competitive research projects.

As regards infrastructure, issues concern shortage or lack of suitable premises for carrying out work (offices, classrooms, laboratories, computer rooms, etc); poor quality of infrastructure (e.g. equipment and laboratory instruments); imbalances in the distribution of facilities among institutes and research groups; shortage of equipment (e.g. computers); lack of basic infrastructure for innovation (ICT), and more. These conditions make the managers of research institute try and achieve synergies, but more often than not they are forced to take drastic solutions (e.g. re-orienting agendas and programs, scaling down ambitions), unless they manage to attract the attention of outside benefactors.

Therefore, research funding and infrastructure are, together, a key element in the governance of STR, and constitute a frame of responsibility of crucial importance, concerning which some practical options can be identified.

**Rationale**

Research funding and adequate infrastructure are necessary (though not sufficient) conditions for successful scientific and innovation activities.

** Practical Options**

**PO159: Strengthening public structures in charge of S&T funding policies**

In many countries, public bodies coordinating policies for funding science and technology research need to be strengthened. This can be done through various measures, such as those...
suggested in several SET-DEV workshops: institutional building initiatives including creating \textit{ad hoc} structures, strengthening liaison channels between existing structures belonging to different public institutions, etc; allocation of human and material resources; specific capacity building programs for staff such as refresher courses for managers, training for officials on issues of science policy, different forms of research funding, relationships with funding sources, management of funds, etc.

**PO160: Targeting research funds**

Apart from budgetary allocations, it is crucial to identify and target research funds so that research programs that are most relevant to national needs and that meet the expectations of the population receive support first. This conclusion was made on the basis of the analysis of the situation in Kenya but it is probably relevant to all research systems. Such targeting can be done, for example, by separating research funds from education funds; strengthening public structures for the evaluation of STR programs (see Area 4); identifying priority action areas in conjunction with stakeholders (see above).

**PO161: Supporting STR actors in fundraising activities**

It is vital to assist STR actors in their efforts to raise funds. In this regard, based on the experiences of SET-DEV countries, the following measures can be taken: simplifying procedures for requesting public funds; setting up service facilities at national and local levels to link research actors with international donors; supporting the establishment of partnerships and networks involving researchers and private actors. All this should be added, of course, to what can and should be done by individual research organisations (see mediation area). There are also some interesting experiences involving the acquisition and "optimisation" of available resources (see box).

**Network synergies for science institutions**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>BECA (Biosciences East and Central Africa), is based in Nairobi and financed by the Canadian cooperation agency. BECA aims to become the hub of a network of institutions present at a regional level, in order to exploit economies of scale and network synergies to favour the strengthening and new configuration of existing institutions (instead of competing with them), thereby directly pointing to technological innovation in farming.</td>
</tr>
</tbody>
</table>

Chataway J., Smith J., Wield D., 2005

**PO162: Acquiring adequate infrastructures**

It is important from the point of view of STR governance to ensure adequate infrastructures for research, both of general nature (e.g. providing the necessary national information infrastructure) (see box), and for individual institutions (offices, rooms, laboratories, equipment, libraries, etc). In partnership with private and international actors public actors can, for example, work together on the allocation of funds to build new infrastructure, address excessive imbalances in the provisions in different areas of research etc. Civil society actors can focus on lobbying, awareness raising and public communication activities to encourage public authorities to guarantee infrastructure for research as a vital means to pursue public policy objectives such as health, the fight against poverty, etc.
“After mobile phones were made available to fishermen in Kerala, they were able to call several markets and agree on selling prices before landing their fish. Within a few weeks the dispersion in fish prices fell and there was no more wastage. The profits of fishermen increased 9 percent while the average price of fish fell 4 percent—to the delight of customers.

(...) authors Shanthi Divakaran, Anil Srivastava, and Mark Williams conclude that India needs to improve the ease and cost of accessing and sharing information and knowledge among enterprises, knowledge workers, and researchers.

Upgrading the information infrastructure for innovation requires:
- making information and communication technology (ICT) more available to both rural and urban users, and
- strengthening India’s National Research and Education Network (NREN) infrastructure for high-end research institutions.”

Excerpt from Dutz 2007

PO163: Updating infrastructure

Basic infrastructure should not only be guaranteed but constantly updated. At both central and local government level this usually involves, among other things, the employment of managers and ad hoc technical staff, the acquisition of information, at international level, about new machinery and equipment, the establishment of partnerships and collaboration with donors and strategic suppliers, and more.

PO164: Infrastructure maintenance

Infrastructure should not only be acquired and updated, but also maintained. Again, especially in the case of individual institutions, it is important to employ and train managers and ad hoc technical staff, and manage relationships with donors and strategic suppliers. Joint supervisory committees on the state of infrastructure can also be set up, with the participation of researchers, research managers, local administrators and/or representatives of central government.

PO165: Sharing research infrastructures

To implement programs of particular complexity it may be necessary to share research facilities or create a single infrastructure for several institutes, such as, for example, the Institute of Life Sciences, which operates in Hyderabad University (see Area 2), or in the case of accessing via internet international infrastructures (e.g., calculation infrastructures). Sharing infrastructure within a university or by a group of institutions operating in the same geographical area may also be useful in situations of special need, or temporary unavailability of resources.
LESSONS LEARNT ON GOVERNANCE

LESSONS LEARNT ON GOVERNANCE: KENYA

- There are benefits to be gained from mainstreaming principles of good governance into STR processes

There are a number of accepted principles or norms of good governance which are appropriate to mainstream in STR processes. These include effectiveness in the relation to scientific practice and management, and scientific communication; sustainability in terms of STI’s contribution to sustainable development; transparency and accountability of the scientific community to the range of stakeholders with which it interacts; and, participation and inclusion to ensure the involvement of the range of stakeholders, from policy-makers, men and women, civil society organisations, formal and informal business sector organisations, and so forth.

- Transparency at the international level is also essential

Kenya and other developing countries should be used responsibly and transparently for research, experimentation and drug testing - with the public being made aware of, and consulted about, such work.

LESSONS LEARNT ON GOVERNANCE: INDIA

- In order to enhance the dialogue and democracy in policy setting (in the light of discussions in inclusive innovation) there is a need to adopt the principles of plurality, justice, equity (see the Knowledge Swaraj: An Indian Manifesto on Science and Technology).

- As per the project observations in India, there is a need to involve a plurality of experts that includes scientific communities at the university and research institutions but also civil society organisations in policy making through dialogue. Government policies can in fact evolve on the basis of recommendations from broadly constituted task groups that are more representative of science society relations than just leaving this to science administrators alone.

- At appropriate levels there is need to organise capacity building programmes for civil servants in charge of coordinating S&T policies, to encourage them to promote the participation of public, research, civil society and private actors in science governance.

- There is the need to move on in the process to decentralise and provide autonomy to the universities, by delegating more power to constituent academic units to take decision regarding mobilisation and expenditure of funds.

- There is also a need to increase funds and infrastructures for research and enable different stakeholders to access this infrastructure for public good.
For further information, see also:

Area 1: frames of responsibility 1, 2, 4
Area 2: frames of responsibility 5, 8, 9
Area 3: frames of responsibility 13, 14, 15
Area 4: frames of responsibility 18, 19, 21
Area 5: frames of responsibility 27, 28
Area 7: frames of responsibility 35, 37, 39
Area 8: frames of responsibility 42, 43
SUMMARY

Area 6 - Governance

Frame of responsibility 30:
Quality of policy setting

Practical Options
PO130: PROMOTING PROGRAMS FOR SHARING KNOWLEDGE NEEDED FOR POLICY SETTING
PO131: HARMONIZING THE POLICIES AND REGULATIONS ON STR
PO132: TAKING MEASURES TO LIMIT EXTERNAL INTERFERENCES IN AREAS PERTAINING TO NATIONAL INTERESTS
PO133: ASSURING THAT POLICIES MAKE CONSTANT REFERENCE TO WELL-ESTABLISHED ETHICAL PRINCIPLES FOR RESEARCH
PO134: PROMOTING EXCHANGES AND NETWORKING AMONG DECISION-MAKERS AT THE REGIONAL AND INTERNATIONAL LEVEL ON S&T POLICIES
PO135: ASSIGNING A PROPER ROLE TO SOCIAL SCIENCES IN STR MANAGEMENT AND GOVERNANCE
PO136: CREATING AUTHORITIES ON KEY POLICY ISSUES
PO137: FILLING THE GAPS IN SCIENTIFIC PERSONNEL FOR SPECIFIC KEY ROLES OR SECTORS

Frame of responsibility 31:
Dialogue and participation in policy making

Practical Options
PO138: ENCOURAGING BROADER PARTICIPATION IN STR IN SECTORS NOT YET SUFFICIENTLY OPEN TO THE PUBLIC
PO139: PROMOTING AND DISSEMINATING NATIONAL AND LOCAL MAPS OF STR ACTORS
PO140: INVOLVING SCIENTIFIC COMMUNITIES IN SETTING POLICIES AT LOCAL LEVEL
PO141: PROMOTING THE INVOLVEMENT OF PRIVATE ACTORS IN S&T
PO142: INVOLVING NEW GENERATIONS OF YOUNG RESEARCHERS IN S&T DECISION MAKING
PO143: ENHANCING THE ROLE OF YOUNG CIVIL SERVANTS WHO ARE INTERESTED IN S&T ISSUES
PO144: INVOLVING CIVIL SOCIETY ORGANISATIONS IN DECISION MAKING

Frame of responsibility 32:
Policies implementation

Practical Options
PO145: ENCOURAGING THE IMPLEMENTATION OF REGIONAL STRATEGIES
PO146: FOSTERING COOPERATION AMONG DIFFERENT PROJECTS IN THE SAME AREA
PO147: CREATING PARTNERSHIPS TO COPE WITH CRISES OR EMERGENCIES
PO148: IMPLEMENTING PREVENTIVE MANAGEMENT OF THE SOCIAL, ECONOMIC, ENVIRONMENTAL IMPACTS OF TECHNOLOGICAL DECISIONS
PO149: ADOPTING CERTIFICATION SYSTEMS AT THE LOCAL LEVEL
PO150: PROMOTING MONITORING STRUCTURES FOR FOSTERING TRANSPARENCY IN S&T POLICIES IMPLEMENTATION

PO151: INTRODUCING CAPACITY BUILDING PROGRAMS FOR CIVIL SERVANTS IN CHARGE OF COORDINATING S&T POLICIES

Frame of responsibility 33: Participative structures for stakeholders at local level

**Practical Options**

PO152: EXPERIMENTING WITH NEW FORMS OF CONSULTATION AND CONSENSUS BUILDING AMONG BENEFICIARIES

PO153: CREATION OF LOCAL NETWORKS AND PARTNERSHIPS

PO154: PROMOTING PROJECT COMMITMENT AND PROJECT OWNERSHIP AMONG LOCAL STAKEHOLDERS

PO155: ENCOURAGING THE INVOLVEMENT OF LOCAL POLITICAL, TRADITIONAL AND RELIGIOUS LEADERS

PO156: PROMOTING THE INVOLVEMENT OF LOCAL WOMEN-LEADERS

PO157: SUPPORTING THE EMPOWERMENT OF CIVIL SOCIETY ORGANISATIONS IN THE FIELD OF S&T

PO158: PROMOTING CONFLICT RESOLUTION AT THE LOCAL LEVEL

Frame of responsibility 34: Financial resources and infrastructure for research

**Practical Options**

PO159: STRENGTHENING PUBLIC STRUCTURES IN CHARGE OF S&T FUNDING POLICIES

PO160: TARGETING RESEARCH FUNDS

PO161: SUPPORTING STR ACTORS IN FUNDRAISING ACTIVITIES

PO162: ACQUIRING ADEQUATE INFRASTRUCTURES

PO163: UPDATING INFRASTRUCTURE

PO164: INFRASTRUCTURE MAINTENANCE

PO165: SHARING RESEARCH INFRASTRUCTURES

Lessons learnt Kenya

- There are benefits to be gained from mainstreaming principles of good governance into STR processes
- Transparency at the international level is also essential
Lessons learnt India

- In order to enhance the dialogue and democracy in policy setting there is a need to adopt the principles of plurality, justice, equity.
- There is a need to involve the scientific communities at the university and research institution level in the policy making through dialogue.
- Need to organise capacity building programmes for civil servants in charge of coordinating S&T policies.
- Need to move on in the process to decentralize and provide autonomy to the universities.
- Need to increase funds and infrastructures for research.
Chapter Seven

Area 7

Gender

A essential area of STR socialisation includes all the actions, practices, norms and programs for integrating gender as a constitutive element of scientific praxis.

This area is crucial insomuch as if, from now on, gender aspects related to STR will be not placed at the centre of the attention, research systems will be likely not only to waste brains which represent a key asset for research but also to lose a fundamental contribution, in terms of styles of thinking, visions, points of view, fertile imagination and sensitiveness.

On the basis of SET-DEV experience and literature research one can say that the gender dimension is critical when women’s presence in the research world and women’s scientific careers are concerned. Often academia proves to be an unfriendly environment for women in which one can find a hidden structure of discrimination. A recurring problem is the so called “vertical segregation” of women in the scientific field making it difficult for women to reach top positions. Another frequent problem is “horizontal segregation” which leads to women and men concentrating in different disciplinary fields, with women being a minority in the so called “hard” sciences.

Other problems are the male-oriented organisation of career paths, the difficulties in reconciling work and family commitments for women researchers, the presence of stereotypes and cultural constraints, the lack of female role models for young girls willing a career in science, the lack or scarcity of specific support policies for women in science and so on.

Another issue is the “genderisation” of epistemological and methodological assumptions and the very contents of scientific disciplines which, as several studies point out, were established without consideration of the female gender, if not in opposition to it. In other words, in modern science gender influences the production of knowledge.

Finally, for many cultures there is a challenge of accepting women in a position of scientific leadership be it a single research centre or a national research network.

Under SET-DEV an effort has been made to identify a set of frames of responsibility dealing with the issues of gender. The set includes the following frames of responsibility:

- equal opportunity and transparency;
- reconciliation and support;
- raising awareness about gender issues in STR;
- knowledge production about gender issues in STR;
- movement on gender issues in science and technology.
In the world of science and technology, women do not yet have full citizenship. This situation has several aspects. One of them is that there is still no gender equality in careers and in everyday work, while at the same time there are significant problems of transparency in the procedures for promotions and rewarding merit, vis-à-vis their male colleagues (e.g. see Bal 2005).

The issue of equal opportunities and transparency concerns all national research contexts. SET-DEV has identified some recurring problems in India, Kenya and Europe.

The first major problem is “vertical gender segregation” which prevents women from accessing top positions in science careers. Another is “horizontal segregation”, which involves the widespread phenomenon of women and men being concentrated in different scientific domains (e.g. women are a minority in “hard” sciences). Other problems closely related to those already mentioned generally involve different approaches to gender and science, such as the gender bias in knowledge production, or the adoption of a false “neutral” approach to gender in institutes that sometimes is a disguise for discrimination, the “male oriented” organisation of career paths.

SET-DEV has also identified some specific barriers to significant numbers of women in STR: difficulties in accessing informal communication networks (where important decisions are taken); discrimination in the selection of editorial boards of academic journals and in the allocation of prestigious scientific awards; “vertical segregation” in prestigious scientific bodies; discrimination in favour of husbands in research institutes (e.g. in specific situations in India) both in the allocation of positions and assignments in publications; difficulties for women researchers in obtaining public funding; marginalisation in research activities; marginalisation in the allocation of scientific jobs when women are urged to concentrate on the experimental aspects of research work and less on theory; allocation to women researchers purely administrative tasks which excludes them from actual research and hinder career advancement. All this sometimes occurs in situations where a girl’s very right to education, even if stated in principle, is not fully respected, for cultural (see also below) and material reasons, which deprives research of a "critical mass" of women.

Discrimination of female researchers and the lack of transparency in career dynamisms are a serious threat to STR: it leads to the loss of valuable human resources, as well as sensibilities, viewpoints, approaches to knowledge that would enrich research. Equal opportunities and transparency, thus, represent a fundamental frame of responsibility, which should involve not only decision makers and researchers but all citizens who care about the future of society in an era where knowledge has become the main resource. In this regard, several practical options can be cited.
PO166: Monitoring the number of women scientists and the type of work they do

A fundamental type of intervention to promote women in STR is to monitor numbers and/or the type of work they do. Monitoring can take place at the national level through collecting data from individual research institutions, as is done in India by the INSA and the Task Force on Women in Science (see box). Such monitoring can also be implemented at the state or decentralised government levels, using a more qualitative approach (such as periodic meetings). The same can be done within individual research organisations, as an instrument of self-awareness and control of human resource practices. In this monitoring the heterogeneity in the social background of women should also be taken into account, with a special focus with women from marginalised groups.

**MONITORING THE ACCESS AND RETENTION OF WOMEN IN SCIENTIFIC CAREERS IN INDIA**

Practices

The Indian National Science Academy (INSA) set up in 2004 a committee to study issues related to women's careers in science in India and to suggest measures to encourage greater participation of women in scientific practice. In this context, the INSA published a report entitled “Science Career for Indian Women: An examination of Indian women’s access to and retention in scientific careers”, which outlines the presence of women in science faculties. The report was based on a study commissioned by the Research Centre for Women's Studies - SNDT Women's University in Mumbai, to analyze the factors that currently affect women's careers. The report also contains statistical data on female enrolment in universities, numbers of the technical and research staff of key national institutions, awards and prizes given to women. The report also analyzes science policies in terms of gender and makes recommendations for national agencies, universities and research institutes.

[http://www.insaindia.org/science.htm](http://www.insaindia.org/science.htm)

**VISIBILITY OF WOMEN RESEARCHERS: AN ONLINE DIRECTORY**

Practices

The Task Force on Women in Science was established on the recommendation of the Indian Prime Minister’s Scientific Advisory Council, to ensure a constant focus on women in science and the enactment of appropriate measures. An online directory was set up that contains CVs of women scientists and engineers. The database provides information on personal data, training, work experience, membership of networks and associations, publications and awards. Accessible and open to everyone, the directory is a tool to negotiate the participation of women in promotional, academic and decision making activities and events, such as participation in conferences, public workshops, membership of committees and other decision-making bodies, awards and scholarships. The promoters of the database aim at launching a continuous and lasting data recording process. At present, the directory contains the CVs of almost 700 women researchers.

[http://indianwomenscientists.in/](http://indianwomenscientists.in/)
**PO167: Creation and application of gender-sensitive indicators**

One way of helping to create an environment more conducive to the presence and careers of women is to define and apply gender-sensitive indicators, which can be used to assess quality of research institutes. One such attempt was made in India by the National Assessment and Accreditation Council (NAAC) (see box).

**Gender-sensitive indicators in India**

**Practices**

In India, the National Assessment and Accreditation Council (NAAC) has recently introduced policies to update its criteria for evaluating recognized universities. In particular, the “Gender Sensitive Quality Indicators” were introduced to include gender in evaluation practices. These involve the collection of data by gender on different aspects such as CVs; participation in workshops and awards; research and consultancy; use of infrastructure; support to students; decision-making and management roles.

NAAC 2006

**PO168: Establishing mechanisms to improve gender balance in scientific bodies**

There are several mechanisms and tools that can be used to guarantee better gender balance within scientific organisations, including: the establishment of entrance quotas; targeted scouting at universities; the creation of support services for women researchers; the adoption of organisational and financial support for women researchers re-entering the research community; fellowships such as those in some African countries (see box) and scholarship schemes like those promoted in India by the Department of Science & Technology (see box).

**AWARD – A fellowship for African women researchers**

**Practices**

To address the difficulties that young African women researchers find in agriculture, the CGIAR has started up the “African Women in Agricultural Research and Development” (AWARD) Fellowship, in cooperation with many organisations including the non-governmental network AWLAENet. It is a pilot initiative, designed to support the professional development of 20 young women scientists from both a scientific and personnel management standpoint, in order to facilitate the training of leading women scientists and to strengthen their research institutes. The Fellowship is available for 2 years and envisages: the start-up of a mentoring programme involving each young woman researcher liaising with their respective senior woman scientist; activities and funding geared to presenting the beneficiaries’ studies in the main scientific conferences; support to developing the skills for handling scientific teams through two training courses dedicated to leadership and negotiation; access to global networks of women researchers. At the end of the project, the fellowship winners were asked to become mentors for other young women researchers.

The pilot programme, which ended in 2008, gave rise to a stable fellowship initiative addressed to 60 women scientists involved in agriculture: besides Kenya, these scientists also come from Ethiopia, Ghana, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda and Zambia.

http://www.genderdiversity.cgiar.org/resource/award.asp
Practices

One of the most serious problems for women researchers is that of returning to work after taking leave due to family commitments and motherhood. In this regard, the Science & Society Division, Dept. of Science & Technology, Ministry of Science & Technology of India, promoted in 2003 the “Scholarship Scheme for Women Scientists and Technologists.” This programme provides opportunities for women aged between 30 and 50 who intend to return to the world of high-level research. The programme grants scholarships for research in frontier areas of science and engineering on socially important problems, internships and self-employment in the field of science and technology. These funds regard experiences in both research institutions and other types of organisations (e.g. NGOs). To disseminate the initiative, workshops are organised in several Indian states, including Andhra Pradesh.

Since 2003, 539 projects have been funded in the fields of life sciences, chemistry, physics and mathematics, engineering sciences, earth sciences and the atmosphere. The DST has started to monitor funding activities and found that on average the level of quality was good. Moreover, 25% of women who participated in the programme found employment in universities and national research laboratories.

www.dst.gov.in/scientific-programme/womenscientists.htm

PO169: Greater communication of selection and award criteria

A merit-based system that does not discriminate against women in research organisations requires greater openness and transparency of the application of criteria for staff selection and the award of honours and prizes. As examples in Europe, India and Africa demonstrate, the following actions bring positive results: greater publicity of competition announcements and longer application times; publication of evaluation criteria; publication of the names of evaluation committee members and their curricula; publication of committee meeting minutes; efficient procedures to handle appeals.

PO170: Establishing dedicated offices or appointing staff to monitor the effective application of legislation on women researchers

To monitor the application of policies and legislation that help to create an enabling occupational environment for women researchers, specific offices or services can be set up at central, state or local level, as well as in individual institutions. Dedicated staff and managers can be used for this purpose within existing organisations. These facilities, staff and managers can carry out studies, collect data, carry out periodic evaluation at local level, develop guidelines, organise information and awareness seminars, etc., using monitoring tools such as those used by INSA and the Task Force on Women in Science in India (see above).

PO171: Promoting mentoring for women scientists

A key tool to support women's careers in research is mentoring, either by individual members of staff or through a dedicated support service. In both cases a series of actions is required to identify, train and motivate people to become mentors. Whenever possible, senior women should be preferred as mentors. Mentoring can be activated in individual institutions or promoted as part of broader programmes or projects, which include support for
women’s scientific careers from school age and in all subsequent stages of integration into the world of research (see box).

### Support to Women’s Scientific Careers in Africa

**Practices**

Support to girls’ education and then to their scientific career is one of the key aims of the non-governmental network African Women Leaders in Agriculture and Environment Network (AWLAENet). One of the AWLAENet programmes is a strategic approach to increase the pool of girls with potential to join universities and occupy positions of leadership. It involves scholarships for needy but bright girls, tutoring, career guidance mentoring. To date, 50,000 girls in total have been supported by the programme. The AWLAENet activities enjoy the support of partners like the Directorate of International Development, Government of Netherlands (DGIS), Winrock International, and the Gender and Diversity program of the CGIAR.

[www.awlaenet.org](http://www.awlaenet.org)

### “WE CAN” Programme

**Practices**

The African Technology Policy Studies (ATPS) has recently launched the “Women Innovation Challenge (WE CAN) Programme”, an innovative mentoring programme that also fosters peer to peer collaboration, an Innovation Challenge Award, Innovation Incubators Initiatives, and a Post Doctoral Fellowship and Internship Programme.

### Supporting Women Researchers in India

In India women constitute a significant section of the science research and workforce in the industry. There are still many well-qualified women scientists who due to various circumstances such as relocation after marriage, break in career due to motherhood or for other family responsibilities or for specific reasons, have been left out of the S&T activities. This part of the scientific manpower needs to be addressed with some specific programmes.

**Schemes for Women Scientists**

The DST has provided a Scholarship Scheme for Women Scientists and Technologists. This provides opportunities to women scientists and technologists between the age group of 30-50 years who are not employed in science and technology related organisations, and desire to return to mainstream science and work as bench-level scientists. Through this endeavour of the Department, a concerted effort is made to give women a strong foothold into the scientific profession, help them re-enter into the mainstream and provide a launch pad for further forays into the field of science and technology, both from the point of view of pure science and its application to societal development. Under this scheme, women scientists are being encouraged to pursue research in frontier areas of science and engineering, on problems of societal relevance and to take up S&T-based internship followed by self-employment.

**Women Entrepreneurship Development Program**

To meet the long felt need to empower women by bringing them into the mainstream of development by improving their economic status and providing them new employment opportunities by way of income generation and self-employment, National Research Development Council (NRDC) has started Women Entrepreneurship Development Program.
NRDC is having expertise of over 50 years in the field of technology transfer and acts as a catalyst to promote, develop and commercialise the technologies/ inventions/patented processes emanating from various national R&D labs. NRDC has licensed more than 2000 technologies to about 5000 licensees, both in India and abroad and has helped the common people, especially women to reap the benefits of technological developments.

The main objectives of the NRDS’s Women Entrepreneurship Development Program are:

- To disseminate information about appropriate technologies for gainful employment to women
- To ensure their involvement in the development of science & technology
- To provide adequate and need based training to ensure that women can enter in all sectors of science & technology having an equal footing with men
- To create awareness about technologies which can reduce the drudgery in their lives.
- To meet these objectives, NRDC with the help of NGOs and experts organises lectures, seminars, workshops, face-to-face get-togethers in different cities to provide information on appropriate technologies, including information on raw materials, plant & machinery required, their availability and approximate cost of the project, market information like demand, etc. Information is also provided relating to Governmental policies and outlook, sector specific incentives, teething troubles associated with new ventures, preparation of project reports, finances from banks, etc.

Other support schemes

There is a government initiative on the introduction of 33% seats in professional and science education for women. In the state of Andhra Pradesh this program has been implemented, and is likely to have a major positive impact on increasing the number of women in science profession. In the state of Andhra Pradesh, there has been a dramatic rise in the number of women students pursuing engineering courses, sciences, medicine and agricultural sciences.

There are also several other schemes for women researchers offered by DST, CSIR, UGC.

Excerpts from University of Hyderabad SET-DEV working papers
Throughout the world, reconciling work and family commitments is one of the biggest problems for working women and of course also women researchers. It is a problem with many facets and, as highlighted in SET-DEV, involves a number of challenges: stress due to the burden of work and family responsibilities, which often leads women researchers to give up their careers or set themselves lower goals; lack of accessible family services in cities, which negatively affects the quality of life of women researchers; lack of services and support for women researchers at place of work; poor implementing of laws supporting women researchers, for example, related to child care and parental leave, to be used both by fathers and mothers; limited scope for travel, with consequent difficulties in participating in conferences, building and maintaining networks, etc. In addition, women researchers often are alone and have no help in tackling these problems. To this must be added the fact that there still is a widespread social and cultural expectation that women take on most of the burden of care responsibilities (to children, aged or sick persons). To promote a better gender balance and a full involvement of men in care responsibilities and in the use of services for the families is crucial for the advancement of women careers in science.

If the participation of women in science is really to be enhanced, these problems must be resolved. Otherwise even the best policies on equal opportunities will fail to make an impact, depriving the research community of the intelligence, knowledge, and sensibilities of women. This important frame of responsibility can include the following practical options.

**PRACTICAL OPTIONS**

**PO172: Introducing work timetables that meet women researchers’ family demands**

One type of effective and widely used tool to support women’s careers is introducing flexible working hours in the organisation where they work to enable them to reconcile work and family commitments. This involves, for example, reorganising office start and finish times, introducing ad hoc and flexible hours for women with young children, scheduling meetings at times compatible with the needs of women researchers. Some of these aspects have been addressed by NISTADS, which promoted a multidisciplinary study on “Women and Science in India”, to identify obstacles to the presence of female researchers in science (Kumar 2008).
**PO173: Introducing support services provided by institutes**

Within individual institutions and research centres specific support services can be introduced for women scientists (or, in the case of universities, for female students), as has been done, for example, in Kenya at the Institute of Woman, Gender and Development Studies at Egerton University. These services can provide practical advice about city services, information about good practices to support women researchers, etc. Other services may include tutoring and mentoring (see below), nurseries for small children, and more.

**PO174: Facilitating access to existing community services**

In some situations, instead of creating new services in research institutes, it might be better to help women access existing community services. The prevalent form of support is that of allocating grants and soft-loans. Support can cover services such as healthcare, children’s education, childcare and relocation, and is usually extended to the employee’s partner and dependants.

**ACCESS TO EXISTING COMMUNITY SERVICES: A EUROPEAN EXAMPLE**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>The German network LaKoG (Conference of Equal Opportunities Advocates at Universities of Applied Sciences in Baden-Württemberg) has promoted a programme for female scientists with children to improve the compatibility of career and family during early career stages (doctoral thesis, postdoctoral lecturer qualification) via financial support for two years. There is also a line of funding for women who plan their re-entry into a research career after parental leave.</td>
</tr>
<tr>
<td>Cacace 2009</td>
</tr>
</tbody>
</table>

**PO175: Promoting measures to create adequate child care and other territorial services**

Local authorities can make a contribution to the promotion of women in scientific careers by boosting the number of family services in the area. This, according to well-established international practice, means creating or strengthening child care services, introducing school transport services for children, boosting school meal services, and more (for a review of these and other services in a number of Western countries, see Cacace 2009).

**PO176: Promoting opportunities for interaction and exchange among researchers in the same institute or different institutes**

To make the promotion of women researchers more relevant and effective, it is important to provide women researchers with opportunities to exchange information and experience on reconciling work and family, involving men in care responsibilities, barriers and opportunities in science careers, equal opportunities, etc. This can be done both in individual institutions and in groups of institutions, as in the case of Women’s Studies Cell, at the School of Social Sciences (University of Hyderabad). Useful activities include informal meetings, regular seminars, and online discussion groups.
RAISING AWARENESS ABOUT GENDER ISSUES IN STR

- **Rationale**

  Policies and resources to boost the participation of women in research might not be effective if there is no *awareness* about gender issues in STR among male colleagues, relatives, research institute managers, decision makers and general public.

  SET-DEV highlighted several **problems** in this field. Mentality is one of them and it is contaminated with prejudices and stereotypes, for example, that women do not have a natural bent for mathematics or sciences, etc., leading to discrimination and low self-esteem in women. Other issues include **lack of a role model for women scientists** in the dominant reference culture; decision-makers and public administrators’ **lack of awareness of female researchers’ problems**; **gender biased expectations from colleagues**, for example, expectations of submissiveness in women and consequent negative evaluation of women who are “assertive”; **difficulty in accepting female competence** as equal to or greater than that of males; **families’ educational preference** for men rather than women; **discrimination of unmarried researchers**, because of the traditionally poor consideration of single women; **careers interrupted** due predominant male models, such as patrilocality (e.g. changes of residence due to marriage). Another issue to be considered is the need to challenge the epistemological and methodological assumptions that were historically gender (male)-biased.

  Tackling these problems seriously is a specific frame of responsibility, concerning which there are several **practical options**.

- **Practical Options**

  **PO177: Promoting public communication initiatives in recognition of dignity of women researchers**

  To make the general public aware of the role of women in science and technology it is essential to launch specific public communication initiatives, using various means and with reference to different target groups and social strata. These initiatives can include information campaigns in the media (TV, radio, the Internet, billboards, etc); specific television programmes such as talk shows, situation comedies, etc; communication programmes using ‘popular’ communication tools, such as street theatre, storytellers, etc. Themes can include general issues such as the advancement of women in society and more specific ones like providing role models of successful women involved in intellectual and scientific work, and the presentation of scientific careers as appropriate for a woman.
BIographies of Women Scientists in India

Practices

In its efforts to address the absence of information on appropriate role models for young women interested in a scientific career, the Women in Science (WIS) Panel published in 2008 a book called “Lilavati's Daughters: The Women Scientists of India”, a collection of essays on the lives of women scientists in India. The book gives short biographies and autobiographies of about 100 Indian women scientists working in a wide range of disciplines, highlighting aspects such as career motivation, obstacles and success factors.

‘Lilavati's Daughters' was successfully presented at the inaugural session the annual meeting of the Indian Academy of Science, by D. Balasubramanian, IAS President. There was news coverage of the publication in numerous national newspapers, including the “Times of India” and the “Hindu”.

www.ias.ac.in/womeninscience/liladaug.htm

P0178: Promoting initiatives to raise awareness among relatives of women researchers

A specific target for awareness raising initiatives on gender issues in STR is the woman researcher’s extended family. As the example of Europe, India and Africa demonstrate, in addition to public communication initiatives such as those described above, the following actions can bring results: information meetings in research institutes; seminars and think tanks on reconciling work and family and the role of men (promoted by the institutes themselves or associations of institutes). Other awareness-raising initiatives can address gender issues in STR starting with contextual elements that affect the critical mass of women in science, for example, facilitating communication and awareness initiatives in villages and city districts, aimed at girls’ parents to encourage school attendance and a choice of career in science and technology.

P0179: Promoting responsible parenthood initiatives

Specific initiatives are needed to overcome the gender unbalance in care responsibilities by targeting the husbands of female researchers to promote responsible parenthood, for instance by availing themselves of parental leaves and similar family support facilities that too often are considered the sole province of women. In Europe, for example, a number of measures have been adopted, ranging from information and awareness initiatives to parental leave (see Cacace 2009).

P0180: Promoting awareness-raising gender initiatives for decision makers and public officers

Decision makers and public officers should be the target of initiatives that provide information and raise awareness of gender issues in STR. As highlighted in a number of SET-DEV studies, relevant initiatives can include: national and regional conferences on women in the research community; information meetings with researcher representatives; visits by decision-makers and public officers to research institutes; refresher workshops for ministry officials responsible for education, research, social services and gender issues, and local administrators who deal with education, infrastructure and social services.
**PO181: Promoting educational and awareness-raising initiatives on gender dynamics within the science community**

Specific training and awareness-raising initiatives on gender dynamics in research should be promoted within the scientific community, involving both women researchers and, especially, their male colleagues. Some initiatives can be directed at this community as a whole to analyse various issues related to the relationship between gender and research, which may then lead to conferences, seminars (see box), special issues of journals, exchange of visits, online discussion groups, and more. Other initiatives should be promoted in individual research institutions, and may include, for example, information and awareness seminars, workshops to explore and address specific operational issues (e.g. support services for women, stereotyping, transparent procedures for career advancement, etc), creation of observatories or other structures to monitor gender issues within organisations, etc. A special attention should be paid to instances of gender bias affecting scientific production itself.

**Seminars on “Women in Science: A Career in Science” in India**

<table>
<thead>
<tr>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Women in science comprise only a small percentage of the total number of working women in India. Although there is no explicit discrimination against women at the various levels of education, attitudinal biases and absence of supportive institutional/social structures have, over the years, operated as powerful forces against talented women realizing their full potential in the pursuit of productive and rewarding careers in science.</td>
</tr>
<tr>
<td>The under-representation of women in science, particularly at the senior levels of teaching and research in India, has become a serious cause of concern for women scientists and women policy planners. Hence there is a need to make women aware of a career in science as a possible option of career and then to retain them in the profession.</td>
</tr>
<tr>
<td>In this direction Women in Science Panel has started a new initiative of conducting a series of seminars/lectures on the topic &quot;Women in Science: A Career in Science&quot;. This is a part of their Role Model Program. These seminars will have presentations by leading women scientists about latest developments in their area of activity, to showcase the work done by women scientists to an audience of both the genders.</td>
</tr>
<tr>
<td>The main objectives of this initiative are as follows:</td>
</tr>
<tr>
<td>• To inspire and motivate young women to take up a career in Science.</td>
</tr>
<tr>
<td>• To create awareness on various career options available to young women scientists.</td>
</tr>
<tr>
<td>• To explore avenues for entrepreneur development for women through Science.”</td>
</tr>
</tbody>
</table>

Extract from the website: www.ias.ac.in/womeninscience/Career.html
Several actors of research in Kenya are engaged in actions of awareness raising about women in science.

The African Academy of Sciences (AAS) has a dedicated research programme promoting women’s role in STR.

The African Centre for Technology Studies (ACTS) promotes greater sensitivity towards the issue of women’s presence in STR.

The National Council of Women of Kenya has a wide-ranging commitment to promoting women and women’s leadership, also in education and STR fields.

The Daystar University has carried out studies and dissemination activities on the theme of sexual harassment in Kenyan universities, as a factor hindering women’s careers.

**PO182: Promoting initiatives raising gender and science awareness in schools**

As highlighted by several cases studied in India and Africa, to promote widespread awareness in society of gender issues in research, it is important to raise awareness in schools at all levels, as concerns women’s dignity and women’s work in general, and specifically the relationship between women and science, to identify and combat stereotypes and prejudices. In this regard, meetings and seminars can be organised for teachers at varying levels, as well as meetings with schoolchildren, or even specific lessons on the issue.
FRAME OF RESPONSIBILITY 38

PRODUCTION OF KNOWLEDGE ON GENDER ISSUES IN STR

Rationale

One of the main problems established by SET-DEV concerning gender issues in STR is the lack of scientific research on women in research, from all the points of view considered so far. In SET-DEV countries (especially in Kenya) there are several studies on specific aspects of women in STR, but there are few studies of a general nature. In addition, the results of these studies tend to remain confined to a small circle of scholars and organisations, as if it were a theme of secondary importance or specialised interest.

In the absence of shared scientific evidence in this field, there is a risk that gender issues in STR will be unable to become part of the already selective decision making agenda in science, technology and innovation. The production, as well as the circulation of scientific knowledge in this area is an important frame of responsibility for all parties interested in the relationship between science and society, which can be addressed through a number of practical options.

Practical Options

P0183: Promoting research on gender issues in STR

To bridge the knowledge gap on gender issues in STR, action should be taken at different levels. For example, specific programmes and funds can be created (or updated where they already exist) by government and international institutions for research in this area. At the level of individual organisations, gender studies should be promoted as department, centres, programmes or working groups (e.g. in sociology, psychology, cultural anthropology faculties). Institutions of national importance can act as drivers and offer guidance, as, for example, NISTADS in India (see box).
Production and circulation of knowledge on women, science and society in India

Practices

The National Institute of Science, Technology & Development Studies (NISTADS) has promoted a study on “Women and Science in India”, to identify obstacles to the presence of female researchers in science.

In Andhra Pradesh, the Women’s Studies Cell, at the School of Social Sciences - University of Hyderabad is part of a broad scientific network and provides, inter alia, advice and assistance to women’s colleges in the area. The Anveshi Research Centre for Women's Studies is active, an important NGO that uses a feminist and multidisciplinary research approach to the study of issues related to the presence of women in education, industry and other key areas of social life.

www.uohyd.info/academic/school_study/social_sciences/index.html  www.anveshi.org/

PO184: Enhancing scientific exchanges about gender issues in STR

For gender issues in STR to move out of the specialised field and to expand and consolidate knowledge on this issue, it is essential to promote scientific exchanges among the actors involved by: setting up working groups in research associations (e.g. national and international sociological associations); setting up portals and websites; setting up networks, such as those that Kenyan women scientists are creating in the areas of technological development and agricultural research. The aforementioned WE CAN Programme also aims to establish networks which enhance inter-regional collaboration between women across Africa, fostering new North-South and South-South Partnerships to increase women’s entrepreneurship and its contribution to economic growth.
FRAME OF RESPONSIBILITY 39

MOVEMENT ON GENDER ISSUES IN SCIENCE AND TECHNOLOGY

- **RATIONALE**

Women researchers feel isolated not only within individual organisations where they work, as mentioned above, but also publicly. In fact, studies and meetings organised under SET-DEV revealed that there is little collective action and few organised movements to tackle discrimination against women in STR and the male dominated approach to science. In fact, although there are many important organisations and programmes in this field, results have been scanty.

Because there are so few collective actors to promote and monitor the presence and roles of women in STR, even the best intentions and the best policies risk bearing no fruit. Consequently, a specific frame of responsibility is to support and strengthen organisations that work in this field.

- **PRACTICAL OPTIONS**

**PO185: Supporting organisations that promote collective action in favour of a broader presence of women in S&T**

It is important to support organisations which promote collective action for a broader presence of women in S&T, with a special consideration for key positions. Examples include the Indian Women Scientist's Association (IWSA) and the African Women Leaders in Agriculture and Environment Network (AWLAE-Net). Organisations of this type should, firstly, be identified and mapped. They may include research centres, NGOs, local offices of international organisations, specific government agencies and local governments, whose role involves working in close contact with actors at the grassroots level. Once identified, these organisations can be supported in a number of ways, for example, by providing funds for specific studies or initiatives, infrastructure and equipment; providing training opportunities for leaders and operators; giving these organisations greater visibility in the media, offering more opportunities for dialogue with public authorities and other relevant actors. Another form of support, used by the Women's Studies Cell at the School of Social Sciences - University of Hyderabad (see above), is to create a network of resources and information.

**PO186: Supporting the participation of women researchers in regional/international associations and networks**

A specific type of collective action in support of women in STR takes place at regional and international levels. In this regard, one practical option is to support the participation of
women researchers, individually and especially through organised groups, in regional/international associations and networks. On the basis of examples studied by SET-DEV in India and Kenya actions may include: funding the participation of organisations and movements in international conferences and seminars; financial and logistical support for exchange visits for women’s organisations from different countries; support for the participation of women researchers in projects abroad, in conjunction with organisations and networks to promote the presence of women in S&T. A special role in linking different experiences and collective organisations can be played by women researchers who have worked abroad, often in international bodies, before returning home.
### LESSONS LEARNT ON GENDER: KENYA

- **Gender-sensitised scientists can help create a more positive perception of science**
  
  Interaction between gender-sensitised scientists and secondary school students and teachers can overcome a negative perception about science as a subject to studied at university and as a career by both girls and boys.

- **STR programmes can be informed by a gender-sensitive approach**
  
  It is recognised that certain technologies have a different impact on women and men. Determining priorities for future STR can thus be informed by ascertaining the respective needs of women and men.

### LESSONS LEARNT ON GENDER: INDIA

There is a need to **create options** for revival of scientific profession for women.

There is a need for better presence of women researchers in scientific bodies (monitoring equal opportunity).

Additional efforts are required in increasing the initiatives to **raise awareness** on importance of supporting the status of women scientists, and spreading information about successful women scientists in middle and high schools.

**For further information, see also:**

- Area 1: frames of responsibility 1, 3, 4
- Area 2: frames of responsibility 5, 7
- Area 3: frames of responsibility 13, 15
- Area 4: frame of responsibility 21
- Area 5: frame of responsibility 24
- Area 6: frames of responsibility 31, 32
SUMMARY

Area 7 - Gender

Frame of responsibility 35:
Equal opportunity and transparency

Practical Options
PO166: Monitoring the number of women scientists and the type of work they do
PO167: Creation and application of gender-sensitive indicators
PO168: Establishing mechanisms to improve gender balance in scientific bodies
PO169: Greater communication of selection and award criteria
PO170: Establishing dedicated offices or appointing staff to monitor the effective application of legislation on women researchers
PO171: Promoting mentoring for women scientists

Frame of responsibility 36:
Reconciliation and support

Practical Options
PO172: Introducing work timetables that meet women researchers’ family demands
PO173: Introducing support services provided by institutes
PO174: Facilitating access to existing community services
PO175: Promoting measures to create adequate child care and other territorial services
PO176: Promoting opportunities for interaction and exchange among researchers in the same institute or different institutes

Frame of responsibility 37:
Raising awareness about gender issues in STR

Practical Options
PO177: Promoting public communication initiatives in recognition of dignity of women researchers
PO178: Promoting initiatives to raise awareness among relatives of women researchers
PO179: Promoting responsible parenthood initiatives
PO180: Promoting awareness-raising gender initiatives for decision makers and public officers
PO181: Promoting educational and awareness-raising initiatives on gender dynamics within the science community
PO182: Promoting initiatives raising gender and science awareness in schools
Frame of responsibility 38:
Production of knowledge on gender issues in STR

**Practical Options**
PO183: PROMOTING RESEARCH ON GENDER ISSUES IN STR
PO184: ENHANCING SCIENTIFIC EXCHANGES ABOUT GENDER ISSUES IN STR

Frame of responsibility 39:
Movement on gender issues in science and technology

**Practical Options**
PO185: SUPPORTING ORGANISATIONS THAT PROMOTE COLLECTIVE ACTION IN FAVOUR OF A BROADER PRESENCE OF WOMEN IN S&T
PO186: SUPPORTING THE PARTICIPATION OF WOMEN RESEARCHERS IN REGIONAL/INTERNATIONAL ASSOCIATIONS AND NETWORKS

Lessons learnt Kenya
- Gender-sensitised scientists can help create a more positive perception of science
- STR programmes can be informed by a gender-sensitive approach

Lessons learnt India
- Need to create options for revival of scientific profession for women.
- Need for better presence of women researchers in scientific bodies (monitoring equal opportunity).
- Increasing the initiatives to raise awareness on importance of supporting the status of women scientists.
Chapter Eight

Area 8

Substantive approaches

This area of STR socialisation is focused on approaches that require a revision of the epistemological, philosophical and cultural foundations of science, often resulting in a critical vision assessment of Western science. These approaches, which here are called “substantive”, are designed to protect and reevaluate endogenous and local knowledge.

The following issues should be considered in this respect: the perception of science and technology within the framework of different philosophical, religious and ethical traditions; the existing gap between different visions of science and technology; the relationships between “western” science and endogenous knowledge; the perception of the added value that is linked to the national research system in the context of international exchange and cooperation policies. All this points at the need for local contextualisation of STR policies, recognition of local knowledge and providing protection of indigenous knowledge from possible exploitation by Western science and technology.

As will be discussed in details on the following pages and as the two “Manifestos” developed under SET-DEV (see the box) have pointed out, the imposition of westernised science and technology brings along many risks, one of which is the failure to recognise scientific traditions representing local forms of knowledge.

In particular, on the basis of SET-DEV, the following specific frames of responsibility can be identified:

- tackling with plurality of knowledge;
- convergence between tradition and modernity;
- self-reliance;
- regulation for indigenous knowledge.

**Embedding science, technology and innovation**

(…) “Both indigenous and global knowledge platforms provide formidable repositories of scientific and technical information relevant to addressing Africa’s development challenges. There is, however, a crucial difference between mere information and living knowledge. Only when information is organized, adapted and adopted for use within a specific cultural milieu, can it be characterized as knowledge. Therefore, this Manifesto questions the universalistic concept of science and technology and pleads for a socialisation of STI, i.e. embedding STI is societies that it aims to serve.” (…)

From The African Manifesto for Science, Technology and Innovation
(...) “Knowledge societies like those in India, which have a continuing tradition of several indigenous knowledge systems, have to contend with the underside where science and technology could also lead to large-scale obsolescence because of market, corporatisation, or a technocratic roll-out of techno-scientific master plans. Yet, given the new science of complexity and climate change and its implications, these very ‘obsolescent’ knowledge systems have the ideas and hopes of human survival. We believe that answers need to be open-sourced—not just from modern science and technology, but produced in knowledge dialogues with these hitherto ‘defeated’ knowledge systems that the subaltern has a unique way of keeping in memory.

Recognising violence in science and the scientific method is not to vilify science but to suggest that science needs a theory of culture in which it should be located. The violence of science begins when science becomes separated from culture.” (...)

From the Knowledge Swaraj: An Indian Manifesto on Science and Technology
Science must treat with respect all forms of knowledge, including traditional knowledge and the expertise that exists in different societies and communities. As highlighted by SET-DEV, when science and technology do not take into account local forms of knowledge (for example in agriculture, health or water management), the knowledge produced and the associated technologies is likely to lack relevance and effectiveness, and may even be harmful to society and target communities, creating situations of injustice and violence (see box below).

**Rationale**

In SET-DEV, plurality of knowledge systems is a key issue.

---

**Plurality of Knowledge Systems: The Indian Experience**

“(…) The Knowledge Swaraj (KS) documents suggests that there have been rich Indian traditions of ‘society speaking to science’, Gandhi’s Hind Swaraj being a good example. KS manifesto argues the case for a need to relook at expertise and how ‘non-scientists can and should be consulted on choices of priority, policy and ethics.’ It seeks to go beyond the dichotomy between tradition and modernity in Indian science by arguing that it is only by being more open to critiques of science from scientists, social scientists, citizens, activists that science can benefit from the rich indigenous Indian traditions of science. This drawing of ideas need to be part of the method of science and not just in a utilitarian sense of looking for active ingredients that could be of use in existing health systems or with a view to celebrate a hoary past. A corollary of this is the idea that society becomes unduly vulnerable when it does not celebrate its plurality of knowledge systems. In this revitalisation of a new and more active social contract experiments on science and technology from civil society needs to be taken seriously. (…)”

Excerpt from: Piloting Knowledge Swaraj: A hand book on Indian Science and Technology, CWS 2009 (within the framework of SET-DEV)
"(...) While Africa can benefit from the global knowledge systems, it is necessary for a sustainable development agenda that African governments and African people proactively engage in creating a STI agenda that is fully embedded in African history, culture, traditions, and socio-political and economic realities. To achieve this, the plural knowledge systems held in different indigenous knowledge communities must be proactively engaged in the STI dialogues. If we consider only one system of “modern” STI, then Africa will remain at the lower rung of the global science and technological ladder, orchestrating the knowledge dependence syndrome; if we recognize the value of our indigenous STI systems as part of a broad spectrum of parallel systems of knowledge and technology, then Africa can take its fate in its own hands and build a future on original innovations at the cross roads of these various knowledge systems."

Excerpt from: ATPS, The African Manifesto for Science, Technology and Innovation, 2010 (within the framework of SET-DEV)

In SET-DEV, **plurality of knowledge systems** is a key issue that has been addressed and formalised especially in the "Knowledge Swaraj Manifesto", drawn up in India, and it is also very important in the "Africa Manifesto for Science, Technology & Innovation’. This was developed in the context of case studies previously mentioned in these guidelines. Based on the considerations contained in these documents and the case studies related to them, tackling plurality of knowledge is a fundamental frame of responsibility, which involves the very meaning of STR in contemporary societies. In this regard, the following **practical options** can be mentioned.

### **Practical Options**

**P0187: Promoting awareness-raising and communication initiatives on the value and potential of indigenous knowledge**

There are many possible programmes to boost indigenous knowledge as a sustainable innovation tool, which can be promoted by researchers as well as governmental, civil society and international actors. Based on the experience of various organisations in India and Kenya, the following awareness-raising and communications initiatives can be considered: producing and disseminating educational materials; setting up museums or new departments in existing museums; radio and television programmes; public meetings and demos; consensus-building activities at local level. It is also important to disseminate documents relating to government policies in this field (see box)
Practices

The Department of Science & Technology (DST), Ministry of Science & Technology, in the Tenth Five-Year Plan stresses the importance of indigenous knowledge and ability to harness technologies of different kinds, including traditional ones.

“The approach in the Tenth Plan would be to lay greater emphasis on the development of indigenous technologies and focus on latest technologies available elsewhere. Significant efforts will be made in those areas where India has a competitive edge globally and where the benefits of S&T can percolate to people who have been denied these benefits so far. This will require emphasis on the development of innovative technologies to meet the country’s needs and to preserve, protect and add value to indigenous resources and biodiversity and protect and preserve the country’s rich traditional knowledge. Harnessing of the full range of technologies (traditional, conventional and modern) would go a long way in national development.”

Mention should also be made of the programmes of the Department of Scientific and Industrial Research, Government of India, which carries out activities aimed at promotion, development, use and transfer of indigenous technologies, and the science communication programmes of the National Council for Science and Technology Communication (NCSTC): they include the promotion of the history of science and technology in India, as well as indigenous knowledge.

www.dst.gov.in/about_us/10plan.pdf

PO188: Identifying expertise at the local level

Plurality of knowledge is best achieved by identifying and involving the actors with the indigenous knowledge. Most SET-DEV case studies in India and Kenya, were centred on an activity of this type. In this context, the following initiatives can be taken: setting up directories and catalogues of local technologies (see box)\(^{14}\); collecting and formalizing oral traditions on certain technologies; organising meetings and seminars at district or village levels; observing and recording the results of technological experiments conducted in conjunction with the local population.

\(^{14}\) See also the case of the Ministry of AYUSH that finances research on different medical systems, or the case of the Foundation for the Revitalisation of Local Health Traditions, that has a directory of traditional healers in South India (source: Leena Abraham).
SUPPORT FOR ETHNO-MEDICINE IN GUJARAT

Practices

Tribes in Gujarat have specific traditional knowledge on how to process plants for medical use. However, this knowledge is likely to disappear because of migration and lack of attention in educational systems. For this reason, Xavier's College in Ahmedabad developed a three year “Monitored Reinforced Learning” (MRL) project, to collect and electronically catalogue local medicinal plants and the way they are processed. It involved teachers and students from the departments of botany, biochemistry and biotechnology. In addition, some tribal medical practitioners were invited to hold meetings with college students.

The project involved about 3,000 students, and led to the production of a CD containing information on over 100 ethno-medicinal plants. This enabled knowledge to be preserved which otherwise would have been lost. The project has been the subject of broadcasts on various local and nation radio stations.

NAAC 2006

KENYAN CIVIL SOCIETY ORGANISATIONS AND INDIGENOUS KNOWLEDGE: SOME EXAMPLES

Practices

The Kenya Institute of Organic Farming (KIOF) encourages organic farming as an instrument of rural development, with particular attention to the support of indigenous knowledge, by means of a “holistic approach to the farming system and including such factors as choice of crops, composting techniques, planting systems, crop storage, animal husbandry, crop protection and soil conservation”.

The Manor House Agricultural Centre (MHAC) carries out programmes geared to achieving food safety among the poor farming population by making use of indigenous knowledge and technologies. Also Participatory Ecological Land Use Management (PELUM) – Kenya promotes the recognition and respect for indigenous knowledge, creativity and innovations.

Excerpt from WP1 report - SET-DEV

PO189: Supporting the fine-tuning of local technologies to respond to local demands

Plurality of knowledge should be promoted by supporting and strengthening the integration of local needs with local technologies. For example, in India the Centre for Sustainable Agriculture (CSA) promotes a sustainable approach to agriculture and the environment based on the use of local traditional technologies. The same applies to Dastkar Andhra, which promotes handicrafts, and WASSAN, which focuses on popular knowledge and indigenous technology as a heritage to be valued and exploited in water and environment programmes. Traditional knowledge concerning animal rearing patterns, unrecognised ethnic breeds, traditional remedies, etc, have been registered and validated by the NGO Anthra on an increasing scale. This NGO is engaged in safeguarding traditional plants by promoting the organisation of “biodiversity parks” and “herbal kitchen gardens”. In addition, the Kenya Agricultural Research Institute (KARI) focuses on devising local technological solutions to meet beneficiaries' needs. These and other examples (see box) demonstrate that the instruments to be used in this regard include: meetings and workshops with various stakeholders to strengthen the capacity to use local forms of knowledge; creating opportunities
for meeting those that possess local technologies and knowledge; creating local technology archives and databases; organising demos.

**CAPACITY BUILDING THROUGH PARTNERSHIPS AND ICT USING INDIGENOUS KNOWLEDGE FOR NATURE CONSERVATION AND NATURAL DISASTER MANAGEMENT**

Practices

Indigenous knowledge (IK) has helped local populations for many centuries in sectors such as nature conservation and the prevention and management of natural disasters and health through traditional medical practices. Despite this, they risk disappearing owing to the poor consideration people have of them and because the main people with this knowledge are now elderly and there is scant written documentation. With the encouragement of the United Nations Environment Programme (UNEP), in 2004, a pilot project was carried out to help the communities to recognise, promote and make use of the indigenous knowledge in fields such as environmental conservation, natural disaster forecasting, traditional medical practices and the alleviation of poverty. Following a field study in Kenya and in other African countries, the project conducted awareness-raising and information activities on the possible uses of indigenous knowledge in these fields and a training course to strengthen the capacities of the various stakeholders (policymakers, researchers, donors, citizens, etc.) to promote and use indigenous knowledge in nature conservation and natural disaster management.

The project saw the creation and inclusion online of a database, divided according to country, in order to store the knowledge, make it accessible to a vaster number of users, and create consensus towards the valorisation of indigenous knowledge, firstly among policymakers, and to provide a place for IK-holders to meet and exchange information and views.

http://www.unep.org/ik/

**PO190: Fostering national and international partnerships and cooperation between institutes championing indigenous knowledge**

To strengthen and legitimise the promotion of the plurality of knowledge and the exploitation of indigenous knowledge (including highly formalised systems, such as Ayurvedic medicine in India), national and international partnership and cooperation programmes can be set up with institutions working in this field. These programmes may centre on information and knowledge exchange (see box); field visits; benchmarking activities; database creation; creation of portals and websites. In India some interesting experiences are under way, such as the Amala Cancer Research Institute, where there is collaboration between oncologists and ayurvedists, or the FRLHT’s recently established institute of ayurvedic and integrative medicine, and others experiences integrating theories and principles of Ayurveda with cardiology, surgery, IIT labs, university departments, etc.
**KENYA: TRADITIONAL MEDICINAL PLANTS AND INTERNATIONAL SCIENTIFIC EXCHANGES**

**Practices**

The Faculty of Sciences of Jomo Kenyatta University has set up a “Herbal Clinic”, an institute which uses traditional medicinal plants for treating pathologies such as asthma, HIV/AIDS, malaria and typhoid.

Although there are many places of traditional treatment in Kenya and in other African states, very few have research functions and features of institutionalisation and direct links with academic science as in the experience reported here. For its very peculiarity, the Herbal Clinic has been visited by experts of St. Lawrence University, Germany, and of the University of Cape Town, South Africa.

**UNDp 2004**

**PO191: Promoting partnerships for research and experimentation to integrate mainstream scientific approaches and practices with traditional technologies**

Partnerships between research institutes and those that possess local and traditional knowledge, such as representatives of indigenous peoples, can effectively satisfy different needs. These needs include collecting and classifying local forms of knowledge, finding ways of exploiting this knowledge scientifically, culturally and economically. Important examples are the Indigenous Food Plants Programme, in Kenya (see box) and the Sanketika Mandala Abhyudaya Pranalika (SMAP) in India (see box).

**INDIGENOUS FOOD PLANTS PROGRAMME - KENYA**

**Practices**

In 1989 the National Museum of Kenya launched the dissemination and training programme called the “Indigenous Food Plants Programme”. The programme – within which the promoter organisation works alongside the local communities – promotes the cultivation, consumption and marketing of indigenous food, thereby trying to limit the prevailing orientation towards exotic and modern foods that are more expensive and, at times, have lower nutrition potential, and also to limit the abandonment and extinction of some local agricultural species.

Local communities are involved in the choice of species to be considered in the formulation of guidelines and in gathering information on the species themselves. In particular, the programme was carried out by integrating research, dissemination and education through instruments like:

- The construction of a database on indigenous food plants
- The organisation of research in the field and in the East African Herbarium
- The gathering of agronomic, nutrition, cultural and market data
- The performance of field demonstrations
- The creation and dissemination of educational materials
- Media involvement

The programme’s activities were thus addressed to various groups of stakeholders: the communities’ young and adult population; women; extension workers; NGOs (including NMK, World Neighbours, World View international, Kenya Freedom for Hunger Council).
Thanks to the programme, a database was constructed containing detailed information on over 850 local food species. A great number of traditional vegetables have been reintroduced in the market, thereby encouraging a resumption of cultivations and favouring the development of the local economy. Moreover, the programme’s impacts include the alleviation of poverty of some groups and the growth of respect for one’s own culture on the part of the Kenyan population. The programme saw the active participation of over 40,000 people, while the activities concerned about 100,000 people. It is estimated that the information disseminated by the programme reached at least 1,000,000 people.

Kaya, 2007; www.unesco.org/most/bpik8.htm

**PROGRAMME FOR THE PROMOTION OF TRADITIONAL SCIENTIFIC AND TECHNOLOGICAL PRACTICES IN ANDHRA PRADESH**

**Practices**

The aim of the programme *Sanketika Mandala Abhyudaya Pranalika (SMAP)*, promoted in 2005 by the *Andhra Pradesh P State Council for Science and Technology*, is to enhance local traditional science and technology and boost employment, especially in rural areas. These practices and technologies involve a wide range of activities in the fields of organic farming and vermiculture, traditional medicine, low cost housing, processing of leather, metal extraction, and traditional handicrafts. The programme organised training courses, workshops, brainstorming sessions, seminars, and exhibitions designed to support and disseminate the skills needed to conduct business activities in these production areas, and to create an environment conducive to the recognition of these practices, through the involvement of local and district institutions, universities, experts and NGOs.

The programme’s activities have received a lot of attention even outside Andhra Pradesh, with visits from researchers of both national (IICT, DMRL, DRDO, ARCI, NMDC and others) and international institutions (Institute of Microstructural Sciences IMS - Canada). In addition, the Department of Science and Technology of the Government of India has selected the project for a documentary film designed to spread this experience.

A critical discussion of Western science and technology inevitably involves a reconsideration of the concept of modernity. Modernity can be defined in many ways, all, however, revolving around some characteristic aspects, such as knowledge, technology, rights of the individual, politics, social stratification, rationalisation of social and economic life and state institutions. In this sense, no society in the world is foreign to modernity, and the "duty" of becoming, in some way, modern. The problem is when the process of modernisation is induced from the outside into a society, causing severe damage to the culture it comes into contact with: an example is colonisation and, today, some aspects of globalisation.

The experience of dialogue and experimentation carried out under SET-DEV confirms what literature and practices all over the world have shown over the past decades: the scientific and technological development needs integration between traditional and modern elements. As highlighted by SET-DEV, there are numerous obstacles to a different concept of modernity, such as difficulties in establishing dialogue and exchange between "official" science and traditional knowledge. These difficulties are a serious problem for STR, which risks, for this reason, becoming a foreign body by society, and so unable to contribute effectively to the needs of human and economic growth. Convergence between tradition and modernity, thus, is an important frame of responsibility for all actors involved in STR. In this regard, some practical options can be identified.

**PO192: Raising awareness of new realities in the science/society relationship taking into account new global dynamisms**

Initiatives aimed at the actors involved in STR dynamics should be put forward to raise awareness of the new realities regarding the relationship between science and society in the contemporary world, in particular decision-makers, researchers, entrepreneurs, the civil society and communicators. They can include workshops, awareness meetings, training programme meetings, public presentation of policies, etc, using if necessary some innovative tools mentioned in Area 3, such as science cafés or science and technology parks. Some is-

---

sues that can be addressed are new ways of producing scientific knowledge; the co-evolution of science and society; global/local relations and "glocal" dynamics in the production of knowledge; the relationship between scientific knowledge and other forms of knowledge; the type of actors involved in the dynamics of science, technology and innovation.

THE NEW GLOBAL SCIENCE: AN EMERGING AWARENESS

Practices

The new relationship between science, technology and society in the modern world, what some call post-modern or knowledge societies, is now of great importance for many public, private, non-governmental and international actors involved in this field. Suffice it to mention, for example, the National Knowledge Commission in India, which was set up to identify and foster conditions to fully integrate India in the global knowledge society and create a knowledge based society (see also below). Or the African Technology Policy Studies Network (ATPS), which promotes modern science, which originates and is adapted to the African context.

http://www.knowledgecommission.gov.in
http://www.atpsnet.org/

PO193: Promoting a critical view of modernity and its relations with science and technology

Actors interested in the relationship between science and society must develop a critical awareness of modernity and its relations with scientific and technological research. Tools to be used can include those mentioned in the previous practical option, and possible topics may be the concept of modernity; the plurality of modernity; the post-modern or knowledge society; the protection of traditional and local knowledge in the context of modernity; the integration of science and traditional knowledge.

PO194: Promoting awareness-raising and communication initiatives on the relationship between national/local cultural, scientific and philosophical traditions and other scientific traditions in the context of the current scientific debate

It is important to promote awareness-raising and communication initiatives, both at national and local level, on the present and future relationship between national/local cultural, scientific and philosophical traditions and other scientific traditions in the context of current scientific debate. These initiatives may involve key actors such as policy makers, researchers, communicators, members of the civil society. These initiatives can include, for example: seminars, publications, radio and television broadcasts. Possible themes could be, for example: the history of science in a given country (see box); the relationship between science, philosophy and traditional knowledge over time; the relationship between science and religious tradition; traditional technologies; the relationship between science and artistic expression, etc.
**India: The Promotion of Native Scientific, Philosophical and Cultural History**

**Practices**

In India, the National Knowledge Commission promotes the goal of integrating India into the knowledge society, emphasizes the value of India’s philosophical, scientific and technological traditions.

“The National Knowledge Commission is looking at the following aspects of traditional knowledge:

1. The principles and basic premises that should govern the documentation and use of our traditional knowledge - that is, our creative, cultural and legacy industries.
2. Plant-based drug formulations of which we have over 40,000 that have come to us through the Ayurveda, Unani, Siddha, Tibetan (all documented) and the non-documented tribal systems of medicine.
3. Traditional agricultural practices of which 4502 have been documented by the ICAR in a series of volumes, with 86 having been validated and 38 cross-validated till December 2005.
4. Our culinary traditions which use some 150 documented vegetables for which nutritional and other information is available, and an equal number of fruits.
5. Culture-specific tourism, for example, through identification of tribal art centres, promoting authentic local performing arts, and making use of the unusual sites and practices that we have in our country.
6. Traditional water harvesting practices which have been well-documented, for example in a book brought out by CSE, New Delhi.
7. Our traditional products, services and art forms that are not included above.”

Mention should also be made the research programmes of the National Institute of Science, Technology and Development Studies (NISTADS) concern the study of traditional knowledge and skills (e.g. in medicine) and the social history of science in India in past centuries.

www.knowledgecommission.gov.in/focus/traditional.asp
www.nistads.res.in/
Self-reliance, the capacity to deal with Western S&T without losing cultural identity and to capitalise on national research and traditional and indigenous knowledge, is usually a driving force for STR.

SET-DEV findings highlight, however, a number of obstacles (both cognitive and operational) in the development of self-reliance in S&T. These obstacles include an imitative approach to S&T management policies with little regard for the cultural and social realities; lack of pride in national S&T products; disregard for locally conducted research as decision-makers and researchers tend to believe that knowledge and technologies produced abroad are, by definition, better than those produced locally; greater attention to Western research interests and topics than to the nation’s specific problems; widespread prejudice regarding the abilities of local researchers; a widespread view of the country as backward compared to other countries (for India: Western countries in the 90s, China and South Korea today) etc.

Promoting self-reliance and full recognition of national and local STR, guaranteeing links with actors and resources at global level, is another emerging frame of responsibility, which could be addressed through practical options such as the following.

### Rationale

Promoting self-reliance and full recognition of national and local STR, guaranteeing links with actors and resources at global level.

### Practical Options

**PO195: Updating researchers on current research and innovation programmes in their country**

One way to overcome or at least limit excessive distrust towards research at national or local levels is to grant indigenous researcher access to the latest information on research and innovation programmes existing in the country. To this end, the following tools can be used: special issues of scientific journals, conferences and seminars on the state of research and innovation in the country, web portals, special pages in government websites (such as ministries or national institutes and councils for research and innovation), and more.

**PO196: Disseminating positive accounts of scientific and innovative capacity in the country**

Another tool to provide a more complete view of research conducted at national and local levels is to supply information on best practices through specialised scientific channels (publications, conferences, etc), and in the mass media. In Kenya, for instance, this is practiced by
the Ministry of Agriculture and other governmental, private and non-profit institutions that promote advances in the field of agricultural technologies

**P0197: Elaborating appropriate indicators of successful research and innovation**

An important way of strengthening self-reliance is to develop and employ adequate indicators of successful research and innovation. These indicators include both those already widely adopted internationally (such as the number of patents, enrolments in science faculties, number of researchers, spending on research, publications, etc.), and new ones related to some aspects of research that have been neglected at times, for example, the number of women in top research positions, repatriation of scientists and engineers, capacity to create partnerships with different actors, participation of stakeholders in projects, etc.

**RESEARCHER REPATRIATION: AN INDICATOR OF SUCCESS**

Several factors are facilitating the return of Indian scientists who had emigrated, such as allowing dual citizenship, improving the quality of life, the assignment of positions of responsibility, etc. Between 2002 and 2005 alone, with the expansion of the biotechnology sector, about 25,000 professionals returned to India, where about 200 start-up companies were established by returning migrants.

Krishna V.V., Krishna U., 2005

**P0198: Promoting a more complete picture of national/local intellectual tradition**

A key tool for promoting self-reliance is to support intellectual, scientific and technological traditions of a given country at national and international levels. This can be done most efficiently through policy documents in the field of STR, or through scientific communication examined in Area 3 (see above). The policy documents of the Indian Government, for example, highlight pride in Indian science and technology as part of an age-old culture (e.g. the framework document “Science and Technology Policy 2003” - DST 2003). Other tools include the promotion of culture (e.g. cinema, television, comics, etc) or the dissemination of historical and philosophical studies, e.g. works by Joseph Ki-Zerbo on African history.
A serious issue in this area is the lack of a cultural, institutional and legal environment for the use of indigenous knowledge, methods and techniques, of which agriculture and health are good examples.

In this regard, SET-DEV identified several difficulties. One is the lack of protection for indigenous intellectual property that allows foreign actors to apprehend the benefits of local forms of knowledge without appropriate compensation. This calls for special reflection since normally protection concerns the interest of individuals and not of a community which in the case of many developing countries is the collective bearer of indigenous knowledge. Other problems include, depending on local situations and contexts, underestimation of indigenous knowledge by policy makers, especially when making practical choices; opposition from lobbies and local clienteles to innovation based on indigenous knowledge; ethnic competition that can hinder the appreciation of innovations produced with indigenous knowledge in certain groups or communities.

SET-DEV highlighted, therefore, a demand for a “regulatory regime” to protect indigenous knowledge. To deal with this frame of responsibility, the following practical options can be considered.

### Practical Options

**PO199: Designing new laws and norms recognizing the value of indigenous knowledge**

The protection of indigenous knowledge requires specific regulatory actions, like those used in the preparation of certain international conventions, such as on biodiversity. For an application of this principle in the African context, see the box below.

#### Knowledge Circulation, Valorisation and Appropriation Strategies in Africa

“(…) Harnessing science and technology for sustainable development requires a free circulation of knowledge, and strategies to translate scientific knowledge into effective use (valorisation) and adoption by a broad range of social groups in society (appropriation). Explicit policy measures to enhance such circulation, valorisation and appropriation need to be developed at national and pan-African level.

Inevitable tensions will arise with the protection of intellectual property rights, as governed by a number of complex international agreements. The Convention on Biodiversity,

The lack of protection for indigenous intellectual property that allows foreign actors to apprehend the benefits of local forms of knowledge without appropriate compensation.
for example, underlines the importance of traditional knowledge as advocated in this Man-
ifesto, and creates a framework for ensuring that local people share in the benefits arising
from the appropriation and use of local knowledge systems and of the resources of their lo-
cal environment. Plant breeder’s rights and farmer’s rights are equally recognized in the
Convention. These resources are of great importance for Africa’s sustainable development
and they must receive adequate attention.

Similar international agreements should further safeguard African access to medical
knowledge and innovation as well access to technologies and innovations for climate change
adaptation and mitigation.(…)

(within the framework of SET-DEV)

**PO200: Lobbying for the regulation of indigenous intellectual property**

Because it is a sensitive issue, the protection and regulation of indigenous intellectual
property requires specific initiatives from research organisations and civil society to pres-
sure and lobby decision makers. Lobbying can then lead to initiatives ranging from informal
meetings to technical seminars or roundtables (see the aforementioned initiatives in India
and Kenya).

**PO201: Supporting benchmarking initiatives on the protection and enhancement of indig-
igenous knowledge**

A particularly suitable tool to promote the protection and enhancement of indigenous
knowledge is benchmarking. To this end, initiatives can be taken to collect and compare dif-
frent experiences promoting and protecting indigenous knowledge at national or interna-
tional levels, and to select the approaches and solutions most appropriate for the context. In
this regard, study and information exchange initiatives have been promoted in Africa by
UNEP, the Jomo Kenyatta University (see above) and Egerton University (Research and Ex-
tension Division), which has a programme aiming to define and examine indigenous tropi-
cal plants for biological insect control in subsistence agriculture. Also of interest are some
aspects of work carried out in Kenya, in the framework of the above mentioned "Herbal
Clinic“ (see box).

**HERBAL CLINIC IN KENYA: RESEARCH AND GUIDELINES**

Practices

The setting up of the “Herbal clinic” by the Faculty of Sciences of Jomo Kenyatta Univer-
sity was particularly difficult. Firstly, through a series of meetings, it was necessary to de-
velop a bond with traditional healers, thereby managing to overcome their mutual reserv-
ations. Starting from these initial contacts, the staff of the Department of Botany has worked
on the systematic identification of the plants used in traditional medicine, gathering material
in the field and distributing them to patients. The research work behind the activities of the
Herbal Clinic have enabled an accurate determination of the proper doses to prescribe to pa-
tients (also thanks to feedback), as well as guaranteeing hygiene standards and administra-
tion procedures through guidelines and scientific publications. Among the greatest chal-
enges to overcome was the resistance on the part of practitioners of modern medicine and
the government’s formal recognition.

UNDP 2004
PO202: Supporting business initiatives to regulate the exploitation of local forms of knowledge

Indigenous knowledge (e.g., in the field of “ethno-medicine”) can become a source of wealth for communities, as long as private actors can be identified to exploit it economically and at the same time respect the needs and rights of these communities. To this end, public, non-profit, international and research stakeholders can help indigenous communities liaise with private companies (through meetings, field visits, seminars, working committees, etc.) and support the conclusion of agreements for the use of local forms of knowledge that are equitable to the communities (Subbaraju in Agribiotec 2006).
LESSONS LEARNT ON SUBSTANTIVE APPROACHES

LESSONS LEARNT ON SUBSTANTIVE APPROACHES: KENYA

Harnessing indigenous knowledge can help make STR more responsive to local conditions and in the design of appropriate initiatives.

It is important to promote research which facilitates the emergence and formalisation of indigenous knowledge, which can be used by the scientific community in determining future STR and in the design of appropriate initiatives responsive to local conditions.

LESSONS LEARNT ON SUBSTANTIVE APPROACHES: INDIA

There is a need for an innovative framework that can reposition India’s knowledge capabilities into a plurality of knowledge systems.

There is a need to reinvent science, technology and innovation as part of traditions of dialogue on knowledge and democracy.

For further information, see also:

Area 1: frame of responsibility 1
Area 3: frames of responsibility 11, 12, 13, 15, 17
Area 4: frame of responsibility 20
Area 5: frame of responsibility 24
Area 6: frame of responsibility 33
SUMMARY

AREA 8 - Substantive approaches

Frame of responsibility 40:
Tackling the plurality of knowledge systems

Practical Options
PO187: PROMOTING AWARENESS-RAISING AND COMMUNICATION INITIATIVES ON THE VALUE AND POTENTIAL OF INDIGENOUS KNOWLEDGE
PO188: IDENTIFYING EXPERTISE AT THE LOCAL LEVEL
PO189: SUPPORTING THE FINE-TUNING OF LOCAL TECHNOLOGIES TO RESPOND TO LOCAL DEMANDS
PO190: FOSTERING NATIONAL AND INTERNATIONAL PARTNERSHIPS AND COOPERATION BETWEEN INSTITUTES CHAMPIONING INDIGENOUS KNOWLEDGE
PO191: PROMOTING PARTNERSHIPS FOR RESEARCH AND EXPERIMENTATION TO INTEGRATE MAINSTREAM SCIENTIFIC APPROACHES AND PRACTICES WITH TRADITIONAL TECHNOLOGIES

Frame of responsibility 41:
Convergence of tradition and modernity

Practical Options
PO192: Raising awareness of new realities in the science/society relationship taking into account the new global dynamisms
PO193: Promoting a critical view of modernity and its relations with science and technology
PO194: Promoting awareness-raising and communication initiatives on the relationship between national/local cultural, scientific and philosophical traditions and other scientific traditions in the context of current scientific debate

Frame of responsibility 42:
Self-reliance

Practical Options
PO195: Updating researchers on current research and innovation programmes in their country
PO196: Disseminating positive accounts of scientific and innovative capacity in the country
PO197: Elaborating appropriate indicators of successful research and innovation
PO198: Promoting a more complete picture of national/local intellectual tradition

Frame of responsibility 43:
Regulation on indigenous knowledge

Practical Options
PO199: Designing new laws and norms recognizing the value of indigenous knowledge
PO200: Lobbying for the regulation of indigenous intellectual property
PO201: Supporting benchmarking initiatives on the protection and enhancement of indigenous knowledge
**PO202: SUPPORTING BUSINESS INITIATIVES TO REGULATE THE EXPLOITATION OF LOCAL FORMS OF KNOWLEDGE**

Lessons learnt Kenya

- Harnessing indigenous knowledge can help make STR more responsive to local conditions and in the design of appropriate initiatives

Lessons learnt India

- Need for an innovative framework that can reposition India’s knowledge capabilities into a plurality of knowledge systems.
- Need to reinvent science, technology and innovation as part of traditions of dialogue on knowledge and democracy.
Appendix
Lessons Learnt: Europe

Though the SET-DEV project was primarily aimed at developing an Indian and African Manifesto, the project partners worked in a multi-lateral dialogue that stimulated learning in all direction between the three continents India-Africa-Europe. Europe can thus benefit from this learning process too, and this section explicates some of those lessons.

Lessons from the African Manifesto for a European S&T policy

The African Manifesto formulates a very powerful argument to contextualise science and technology in Africa. The Manifesto clearly articulates a growing awareness in Africa that it cannot implement foreign models of development if it wants to address properly its specific needs. The focus on the question of leadership and the responsibility incumbent on political leaders in Africa to break the present colonial dependence on Western models of science and technology development and to build local capacity in research based on sound models of socialisation implies pertinent questions to Europe too.

For a European science and technology policy, the African Manifesto poses a challenge. Does Europe have the same awareness of its needs as the basis for a coherent science and technology governance strategy? Or is Europe currently also applying foreign or obsolete models of science and technology socialisation that do not serve European purposes? In the same way that Africa needs leadership in this area, Europe needs a clearly defined vision of how and for what it wants to use science, technology and innovation. This vision needs to be formulated by national politicians and by the EC, but as the fruit of a wide consultation and dialogue in which all relevant stakeholders can provide input.

Lessons from the Indian Manifesto for a European S&T policy

The Indian Manifesto on Science and Technology widens the scope of the debate on the use of science and technology in India through its call for a more participatory and democratic process. The section on plurality of expertise forms a core starting point. Natural and technical scientists should not alone dictate how new technology is applied in society. Because science and technology applications impact many people in many ways, many types of expertise are needed in order to evaluate the consequences and implications. Also in the European context the term “expertise” is still interpreted mostly in terms of academic competence which of course excludes many other considerations.

Gandhi’s Hind Swaraj functioned as an inspiration for writing the Indian Manifesto and provided an ethical imperative to protect the weakest members of Indian society and a political stance to encourage small-scale, sustainable projects. This poses an intriguing challenge of trying to devise some kind of European translation of this ethical grounding. What would be the ideological and ethical specificity of a European vision of self-reliance? Some kind of Gandhian vision seems to be needed in Europe to promote, even in the higher echelons of science governance, the idea of small-scale, sustainable and environmentally proactive science and technology. (And see the effort by four European students to do exactly this, below).

When developing something like a European Manifesto, we would strongly recommend that natural scientist and industry leaders would be actively involved in such a Manifesto
One lesson from the process to write the Indian Manifesto is that it can be very fruitful to engage civil society organisations. It would be a challenge to identify the voices in the debate that are not heard and which would have an important contribution to make.

**Comments on the Lisbon Strategy, from the perspective of the African and Indian Manifesto’s**

From a more global perspective the goals Lisbon Strategy seem not to have been very well designed. In wanting to transform Europe into “the most competitive and dynamic knowledge-based economy in the world” by 2010, the signatories of this document set lofty goals. In doing so they also articulated these same goals in a competitive “we – them” frame of mind that does not seem to conjugate very well with the demands and spirit of our global society. In other words, these goals were articulated at the expense of others. The Lisbon Strategy fails, in other words, to recognise the radical interdependence which is a hallmark of the 21st Century. Such goals need and, we believe on the basis of our SET-DEV experience, can be formulated in terms of partnership and collaboration similar to the UN Millennium Development Goals.

**Lessons for Europe on a trans-cultural approach to technology-generated rules**

The risks faced by indigenous peoples in emerging economies are not dissimilar to those faced by many minorities across Europe especially those to be found in rural areas. If new technologies can be used in India and Africa to bridge the urban/rural divide and preserve and promote cultural attributes, they can be likewise used in Europe for the same purpose. Whether it is so-called Saxon communities in Romania (a dwindling minority) or Asian-origin minorities in the UK (growing minorities), issues such as assimilation, language, tradition, family and other values may be promoted, preserved or put at risk by new technologies such as the Internet, mobile telephony etc.

At this moment in time most EU countries do not have a comprehensive and systemic approach to measuring, channelling, arresting or promoting the impact of new technologies on society and especially on the various and many minorities within such societies. There are a number of sporadic approaches to such issues but on the whole it is fair to say that such impact assessments and related policies in the information society are fragmentary and that this fragmentation does not facilitate the optimal use of resources available. Thus, the idea of an effective Technology (or Information) Society Council with as wide a remit as that recommended for emerging economies (i.e. sociological, legal and anthropological as well as economical/technical) with a special and explicit focus on the needs of minorities would be a useful state-sponsored initiative in those EU countries where it does not yet currently exist.

A number of SET-DEV members are participating in the LexConverge network wherein they are promoting a number of relevant research projects across Europe taking advantage of EU FP7 funding. While these projects are doubtless very valuable their impact would be enhanced further by the existence of national Information Society Councils or Institutes who would then be able to translate the findings and recommendations of empirical research into concrete policies.

**Process lessons for Europe from the SET-DEV experiences**

Reflecting on the learning process originated by SET-DEV in the form of a multilateral dialogue, we might ask whether, together with the ability to socialise science and technology to specific national or local contexts, we shouldn’t as well think about socialising science and technology to the “global ecumene” to re-legitimise it in a plural world where all sorts of differences are interacting and intertwining.
A first consideration concerns the connection, highlighted by some scholars, between emotions, feelings, unconscious dynamics, cultural orientations, myths and the nature of scientific ideas that orient research. The prevalent approaches, practices, representations and policies of science are historically loaded with “western” (often also gender biased) worldviews, styles of thought and criteria and priorities for research. Some of the issues that are increasingly important in the global scientific and technological arena, however, do come from “eastern” or “southern spheres. Thus it becomes all the more important to better understand what this may purport in terms of the production of new thought styles or new forms of scientific imagination that can orient the directions that scientific research is going to take. One of the clear lessons from the SET-DEV process is that taking into account other (that is, non-western) myths, stories and worldviews did help to create new and innovative styles of formulating approaches to ethics and politics of science and technology.

Recognising the full scope of diversity and plurality within scientific and technological research leads to another crucial issue: the gender dynamisms within science. One of the most stable cultural encroachments in science is its gender bias, which tends to reproduce itself in new and more subtle forms, and not solely in Europe. Now, a science still “westernised” and “genderised” will miss crucial energies, intuitions, and rationalities.

To move towards a science and technology that in their deepest, basic principles are more attuned with the human community as whole can be a long term perspective, but it is a perspective for which many inputs from diverse cultural and epistemological standpoints present themselves. SET-DEV case studies and the complex process that has led to the formulation of the Indian and African Manifestos and their endorsement by many different stakeholders in India and Africa provide some indication that such perspectives can also be the result of the social actions of diverse actors in Asia, Africa, Europe and worldwide.

One can cite thinkers who are contributing to the elaboration of new paradigms and theoretical approaches to science and technology, which are more sensitive to cultural diversities. But one can also consider public bodies, civil society organisations, innovative entrepreneurs, and social groups who practice in their daily action a science and a technology closer to the people. This consideration can also inform the way in which the European Commission envisions its scientific partnerships with developing countries and emerging economies: such partnerships have to be constructed on really equal grounds and bi-directional exchange of knowledge and worldviews.

A draft European Manifesto by European students, inspired by the Indian Manifesto

This section identified some of the lessons that Europe can learn from India and Africa, drawing on our experiences in the SET-DEV project. As an example of such learning we want to conclude by moving to the most individual level of learning: from continents and nations we now turn to four European citizens.

Simone Schleper, Louisa Weiss, Hannah Schindler, Jelle van Aanholt, four highly qualified undergraduate students of Maastricht University, worked in the SET-DEV project as part of their being selected into the honours programme of the faculty. They were inspired by the Indian Manifesto and produced their own version of a European Manifesto on science and technology. The 18-page document begins with an introduction from which we quote:

“The roots of science in modern form have been generally traced to seventeenth century Europe and therefore it is seen as distinctively European by many authors. It is believed by some that only Europe could put together the component parts of science in a way which gave science its unique modern effectiveness and character. It is also believed by some that even scientists from geographically non-western lands who have made significant contribu-
tions to the field of science, along with many of their countrymen tend to be highly westernised in diverse ways which go far beyond the scope of their scientific activities and, therefore, not genuine representatives of non-western cultures.” (Aran Prabha, Economic Times, Bombay, 28 November 1981)

In this context, an Indian Manifesto of Science and Technology, the “Knowledge Swaraj” Manifesto, was created in 2009 by an internationally cooperating group of Indian and European scholars of science and technology, participating in the EU project SET-DEV (Science, Ethics and Technological Responsibility in Developing and Emerging Countries, www.set-dev.eu), to reinvestigate the relationship between civil society and experts. The project holds that it is crucial to understand that at least as important as a science and technology policy for India, is the self-rule by Indian people of their science and technology. That not only implies an effort to think from the perspectives of the peoples of India when drawing the policy document, but also an effort to create the necessary accompanying measures by reinventing Indian democracy and its social institutions. In this issue it is attempted to surpass state policy boundaries. The Indian Manifesto is to reinstall the citizen as an expert, as an inventor. In this way, it not only aims at re-establishing the richness of parallel knowledge systems, but also celebrates the morality of the weak and marginalised. The Indian Manifesto set out to rewrite Hind Swaraj and explore the meaning of Indian self-rule of its science and technology. As Gandhi reinvented Europe, while outlining an independent India in Hind Swaraj, the Indian Manifesto argues for reinventing science and technology into a plurality of knowledge and crafts to create cognitive justice and a sustainable future for India and its people.

We, that is four honours students from the Faculty of Arts and Social Sciences at Maastricht University, were so fortunate to be given the possibility to provide some minor contribution to the post reflection of the described Indian Manifesto. Reading the Indian Manifesto of Science and Technology, it became obvious that issues discussed such as plurality, justice and sustainability in the connection with a technified society also equally apply to our European knowledge society. Moreover, in today’s Europe, a special situation concerning growing mistrust on the side of civil society towards experts in the field of science and technology, which are still regarded as vital forces in progressive thinking associated with economic growth, can be observed. A telling example for this trend is provided by the increasing public mistrust concerning the necessity and effect of new therapeutic medications such as vaccinations, which are more and more often rejected by lay society, as could be seen in the recent public discussion about vaccination against uterus cancer in the Netherlands.

In order to discuss the according concepts in detail in relation to the present day European knowledge society, first it is interesting to have a closer look at the origins of Europe’s strong affinity towards scientific progress. Even though important streams of thought and knowledge traditions cannot be assigned to a strictly limited territory, it is important to remark that when talking of Europe we refer to the European Union (EU) as a community based on a common legal and institutional foundation. It is furthermore necessary to stress that a European Manifesto is still hypothetical in character, aiming to provide food for further thought. In a more profound stage, empirical testing would be needed in order to ratify the suggestions in this piece.
Their manifesto then continues with five chapters:

1. An Historical Perspective: From Scientific Revolution to European Risk Society
2. Plurality: On the Diversity of Knowledge and Expertise
3. Justice: Democratizing European Science and Technology
4. Sustainability: Maintaining the Benefits of Development
5. Conclusion: Science and technology Policy Ruled by European Society
Bibliography


http://www.acu.ac.uk/resman/pdf/ManagingUniveristyResearchThe%20caseofGoa.pdf


ATPS (2007d). The 2nd African Regional Youth Congress on Science and Technology. Food Security and Health for Sustainable Development in Africa. ATPS. Nairobi


d’Andrea L., Quaranta G., Quinti G. (2005). Manuale sui processi di socializzazione della ricerca scientifica e tecnologica. CERFE. Rome


Desai M., Fukuda-Parr S., Johansson C., Sagasti F. (2002). Measuring the Technology Achievement of Nations and the Capacity to Participate in the Network Age. Journal of Human Development. 3(1)


http://www.merit.unu.edu/DEIP/Presentations/County%20Case%20presentations/


http://www.indianmba.com/Faculty_Column/FC535/fc535.html


http://www.atpsnet.org/pubs/specialpaper/SPS%2028.pdf


http://www.ias.ac.in/currrsci/jun102005/1731.pdf


Maiti, R., Raghavendra M. (2007). Clinical Trials in India. Pharmacological Research, 56(1)


Mendoza W., Dsouza J. (2010) Democratising the Science and Technology of Climate Change—A Case Study on Indian Network for Ethics in Climate Change (INECC). CED. Bangalore


NAAC – National Assessment and Accreditation Council (2005). *Great Institution of Higher Learning – Accredited Universities in India*. NAAC. Rajajinagar, Bangalore

NAAC – National Assessment and Accreditation Council (2006a). *Community Engagement - Case Presentation*. NAAC. Nagarabhavi, Bangalore


http://www.ias.ac.in/currsci/apr2008/841.pdf


http://www.knowledgecommission.gov.in


NETWAS, ATPS (2007). Water and Sanitation in Urban Africa: Emerging Approaches for Reaching the Un-Served Poor. 18th Regional Water and Sanitation Seminar, 4-8 September 2006, Mombasa. ATPS. Nairobi


Ortega y Gasset J. (1940). Ideas y Creencias, Espasa Calpe. Madrid


Ramanjaneyulu G.V., Kuruganti K. (2009). Sustaining Agriculture in the Era of Climate Change in India. CSA. Secunderabad


Shambu Prasad C., Sindhi S. (s.d.). Coping with Complexity. Mapping Sustainable Agriculture in Orissa using the RTD Framework. Xavier Institute of Management. Bhubaneswar


http://tdc.undp.org/widenew/sharingsearch.asp

http://tdc.undp.org/sie/experiences/vol10/V10_S3_herbalClinic.pdf


http://www.agribiotech2006.com


Web sites
Some of the websites of institutions, organisations and projects mentioned in the text are listed below.

SET-DEV partners
SET-DEV www.set-dev.eu
Consiglio Nazionale delle Ricerche (CNR), Italy www.cnr.it/sitocnr/home.html
African Technology Policy Studies Network (ATPS) www.atpsnet.org
Centre for World Solidarity (CWS) www.cwsy.org
Intermedia NCG www.intermediancg.com/
Knowledge in Civil Society (KICS) www.kicsforum.net
Laboratorio di Scienze della Cittadinanza (LSC) www.scienzecittadinanza.org
Lund University www.lunduniversity.lu.se/
Maastricht University www.maastrichtuniversity.nl/
Minerva Consulting & Communication Sprl. www.minerva-communication.eu/
University of Central Lancashire, Lancashire Business School
www.uclan.ac.uk/schools/lbs/index.php
University of Central Lancashire, CLICT
www.uclan.ac.uk/schools/lancashire_law_school/clict/index.php
University of Hyderabad www.uohyd.info

INDIA
Andhra Pradesh Council for Science & Technology (APCOST) www.apcost.gov.in/
Anveshi Research Centre for Women's Studies http://www.anveshi.org/
Council of Scientific and Industrial Research (CSIR) www.csir.res.in
Environment Protection Training & Research Institute (EPTRI) http://www.eptri.com/
ICTs for Agriculture and Rural Development (ICTARD) http://agriculture.iiit.ac.in/
Indian Academy of Sciences www.ias.ac.in
Indian Academy of Social Sciences www.issaindia.in/oip/32nd_indian_social.asp
Indian Council of Agricultural Research (ICAR) www.icar.org.in
Indian Council of Medical Research (ICMR) http://icmr.nic.in
Indian National Science Academy (INSA) http://insaindia.org/index.php
Indian Women Scientists http://indianwomenscientists.in/#
Institute of Life Sciences www.ilsresearch.org
Ministry of Human Resource Development http://education.nic.in/
Ministry of Health http://mohfw.nic.in/
Ministry of Agriculture, Department of Agriculture & Cooperation http://agricoop.nic.in
Ministry of Science & Technology, Dept. of Science & Technology http://www.dst.gov.in/
National Assessment and Accreditation Council (NAAC) www.naac.gov.in
National Academy of Agricultural Research Management (NAARM) www.naarm.ernet.in/
National Institute of Science, Technology & Development Studies (NISTADS) www.nistads.res.in
National Knowledge Commission, Government of India http://www.knowledgecommission.gov.in/
Open Source Drug Discovery (OSDD) www.osdd.net
Science City Kolkata www.sciencecitykolkata.org.in
Watershed Support Services and Activities Network (WASSAN) www.wassan.org

KENYA/AFRICA
African Centre for Technology Studies (ACTS) http://www.acts.or.ke/
African Ministerial Council on Science and Technology (AMCOST) http://www.nepadst.org/
African Women Leaders in Agriculture and Environment Network (AWLAE-net) http://www.awlaenet.org/
Egerton University http://www.egerton.ac.ke/
International Centre of Insect Physiology and Ecology (ICIPE) www.icipe.org
Kenya Forestry Research Institute (KEFRI) www.kefri.org
Kenya Agricultural Information Network (KAINET) www.kainenet.or.ke
Kenya Agricultural Research Institute (KARI) www.kari.org
Kenya Bureau of Standards (KEBS) www.kebs.org
Kenya Industrial Research and Development Institute (KIRDI) www.kirdi.go.ke
Kenya Institute for Public Policy Research and Analysis (KIPPRA) www.kippra.org
Kenya National Academy of Science (KNAS) www.knascience.org
Kenya Medical Research Institute (KEMRI) www.kemri.org
Kenyatta University www.ku.ac.ke
Ministry of Agriculture (MoA) www.kilimo.go.ke
Ministry of Higher Education, Science and Technology (MOHEST) www.scienceandtechnology.go.ke
Media Association for Environment, Science, Health and Agriculture (MESHA) www.meshanet.org/about.html#
National Council of Science and Technology (NCST) www.ncst.go.ke/
National Economic & Social Council (NESC) www.nesc.go.ke
National Museums of Kenya (NMK) www.museums.or.ke
Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) www.ruforum.org
Rural Outreach Programme (ROP) http://www.ropkenya.org/
University of Nairobi www.uonbi.ac.ke

EUROPE
European Commission http://ec.europa.eu/index_en.htm
European Union http://europa.eu/

International and others
CGIAR – Gender & Diversity http://www.genderdiversity.cgiar.org/
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) www.icrisat.org
International Institute for Sustainable Development – Reporting Services Division (IISD RS) http://www.iisd.ca/