NATO/CCMS pilot study 'Integrated Water Management'

Progress report after the 4th Workshop
Lisbon, Portugal, 2 – 5 March 2005

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1 Introduction

The main objective of the pilot study is exchanging and combining expertise in water system research, considering different dimensions of water management and their intra and inter relations (Fig. 1). The dimension *Integration of knowledge* represents the required competences; it includes natural scientific as well as social and economical aspects, considered as basic information about the functioning of water systems and the chains of the water users, both including conceptual knowledge as well as a situation analysis. The *Organizational Integration* dimension concerns all relevant competences and participation of stakeholders and means an important support for the efficiency of the water management. The *Legislative basis* dimension is the regulating basic framework including and combining all legal aspects.

The knowledge brought together by means of the pilot study, has to contribute to the knowledge of Integrated Water Management in general, including the necessary differentiation, given the wide variety of conditions in the different types of basins or watersheds. Therefore,

both theoretical studies on the functioning of water systems, organisation and legislation as well as specific cases will be discussed.

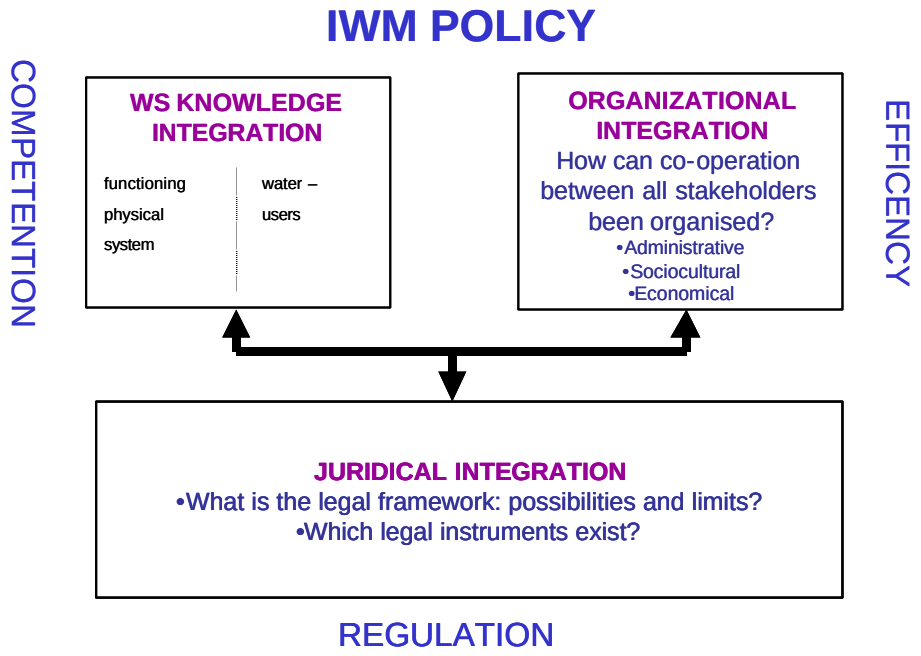

Fig. 1. Different aspects of Integrated Water Management

2 Conceptual background

Setting the scene: a water system approach

Water is a “sine qua non” for life and due to the increasing human population and our growing needs the amount of water needed is increasing steadily (Gleick, 2003). On the other hand, the available water resources are declining. Furthermore, water is not only needed for man but also for all ecosystems.

The main question that has to be addressed is then of course how to use and divide the available water between all users (man and ecosystems) now and in the next generations.

The water system can be seen as a kind of reactor, directing the precipitation through different pathways (physical, chemical and biological processes) back to the atmosphere or sinks like deep groundwater. A water system is:

> *“a coherent and functional unity of surface water, groundwater, riverbed, riverbanks and technical infrastructure, including the occurring plant and animal communities and all associated physical, chemical en biological characteristics and processes".*

It is clear that, in the past until now, the water system has been changed to a large extend to fulfil our water demands. It is equally clear that the way we are using and changing our water system is not sustainable. In recent years, the concept of integrated water (resources) management has been developed. The idea behind this concept dates back to the first UN conference on the human environment in Stockholm (1972), but mainly to the Conference on Water at Mar del Plata in 1977. The next step was the International Conference on Water and Environment in Dublin (1992) where ideas were put forward to the UNCED conference later that year in Rio. Within Agenda 21 this was incorporated:

> *“The holistic management of fresh water as a finite and vulnerable resource, and the integration of sectoral water plans and programs within the framework of national economic and social policy, are of paramount importance for actions in the 1990’s and beyond. Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and social and economic good,*

whose quantity and quality determine the nature of its utilization. To this end, water resources have been protected, taken into account the functioning of aquatic ecosystems and the perenniality of the resource, in order to satisfy and reconcile needs for water in human activities" (Chapter 18, paragraphs 18.6 and 18.8)

So far, efficiency of water management was equated with maximum use of water resources by users (Calder, 99). Environmental and ecological considerations as well as downstream users were given little attention. In a demand driven situation the response to water shortage was to augment the supplies, hence even more reducing the incentive to manage water in a sustainable way! This resulted in a severe deterioration of the natural functioning of the water system. This in turn impairs human use. The reduction of the flow e.g. can severely impact water use: it reduces the assimilative capacity and the discharge of pollutants may lead to toxic conditions and extra costs to public services for the treatment of water.

This brings us to a first crucial question: can we determine the carrying capacity of a water system and in what ways can we manage (increase) this carrying capacity.

Are we able to determine the carrying capacity of a Water System?

Carrying capacity of a watershed could be defined as the amount of water that is available for human use taking into account the amount necessary for the ecosystem so that they can still fulfil their ecosystem functions, which deliver essential ecosystem goods and services to our society (Fig. 2). Related to the socio – economic system, the water system includes three groups of functions: sink, source and life support system. The pressures of using the water system as a source, a sink or a life support system, respectively have mainly impact on the water quantity; the water quality and on the services provided by the natural system and as a consequence immediately on the socio – economic system.

How multiple use and often-conflicting demands can be brought in line with what the natural system can support. During long time, water management has been approached mainly (or even only) from a technological viewpoint. The water system was engineered and problems were solved technically when they appeared. River systems have been manipulated in order to fulfil functions and conditions for human activity without considering consequences, unless some local ones. Therefore, problems were shift in space and time. In this way, the carrying capacity is not considered. All pressures on the natural water system have a feedback effect on human welfare and wellbeing, herewith starting a vicious circle by impacting the socio – economic system again. Preventing the start of this degradation spiral can only be reached by respecting the carrying capacity of the water system.

In order to determine the carrying capacity, a system approach is urged. Therefore, we have to consider the physical and the biological water system as well as the water use processes (water chains) and their interrelations. Land use plays a crucial role and especially agriculture and silviculture can have a pronounced impact on the availability of water. Further, the different storage mechanisms as well as efficiency of water use and reuse determine the carrying capacity. Therefore, shifting from policy and management mainly focussed on impacts on the SINK to tackling pressures on SOURCE and LIFE SUPPORT is urgently needed. Combining all preconditions for preventing to pass the carrying capacity determine the so-called "environmental space". The services that have to be considered for the 'environmental space' are production, information and regulation.

It is necessary for each water basin to create a balance between the "functioning of the water system" and "the impact of the water chain" on it. Therefore, water uses should be tuned to the system and we should shift from adapting the system to the demand to adapting the use to the supply limits of the system. Since factors as technology, demography, society change, preconditions for the carrying capacity have to be dynamic.

Integrated Water Management is a / the tool to respect the necessary preconditions.

Development of river basin plans

If we can determine the carrying capacity, how can we then 'translate' the necessary conditions into planning and management? River basin plans are the crucial instruments synthesising the different choices made. How to make these choices? Pricing may be a good approach.

Sustainable development, protection of biodiversity, and the stand still principal are environmental principles that can influence the water system directly. The precautionary principle, a source oriented approach and rational water use should have an influence on the water chain as well as welfare and the human perception on the water system.

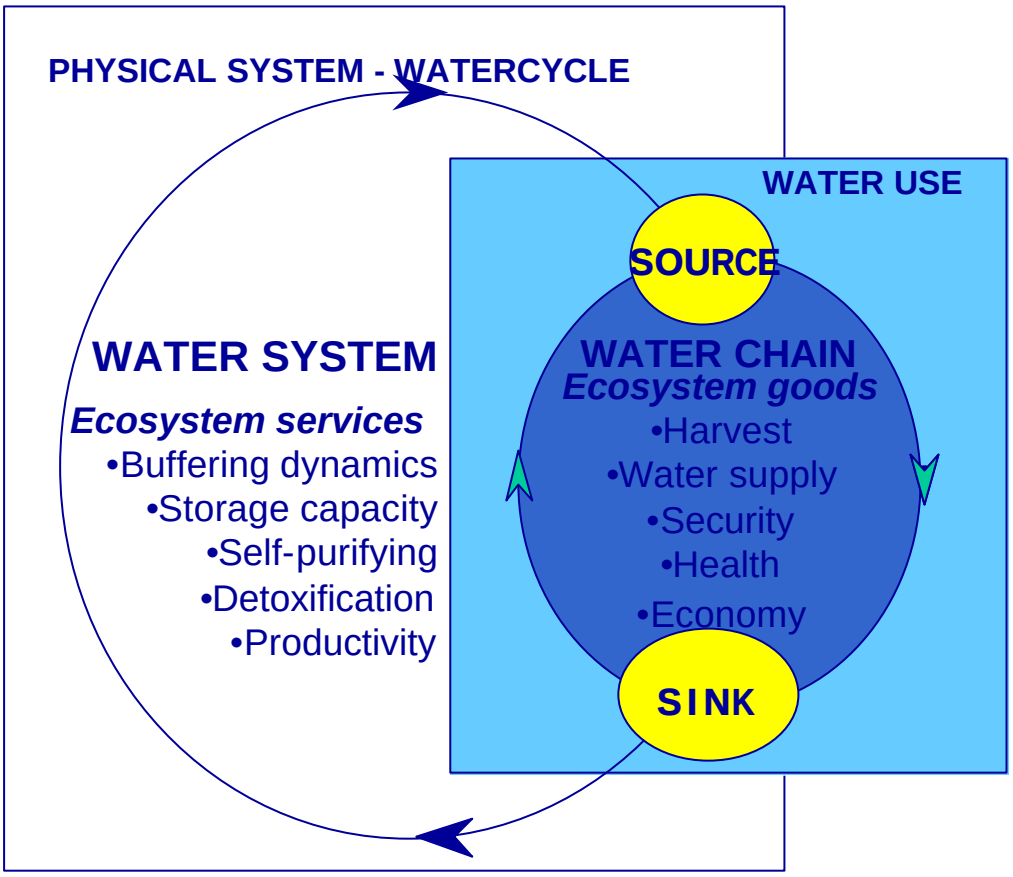

Fig. 2 the water system and the water chain (Bergmans et al., 1999)

3 Final aim and expected outcome

The pilot study aims to learn from comparison by presenting examples to build upon, to prepare publications of scientific papers with concepts, not detailed guidelines, to establish a network for initiating new projects and to enforce capacity building in all participating countries (Figure 3).

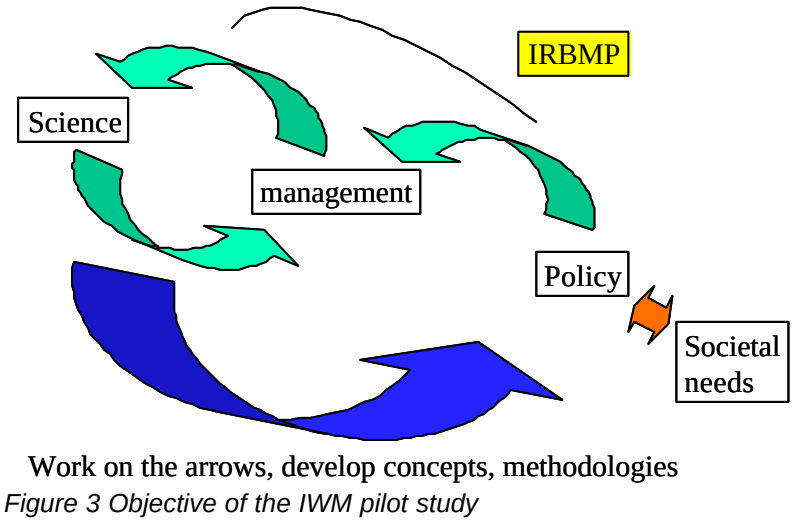

Figure 3 Objective of the IWM pilot study

Expected outcome of the pilot study

Determining indicators defining the carrying capacity of a water system. Whereas the carrying capacity is a point of departure for the development of concepts for river basin management plans, participation and transboundary cooperation get main attention. An important input for these concepts is the comparison and evaluation of IWM in given basins. This information will be the input of a NATO advanced science shop, which should be the final contribution for a book.

4 Methodology

The pilot study addresses to specific issues, requiring an integrated approach. Therefore during the pilot study participants work both during plenary meetings and in working groups. Participants can belong to research institutes, universities, governmental authorities and non-governmental organizations (NGOs). Exchange of information and discussions mainly takes place during workshops. The pilot study lasts three years. Two workshops a year are organised.

The workshops are partly plenary, including also separate working group meetings and an excursion to a relevant case. Therefore workshops are organized at different basins The WG-leader chaired the WG-meetings and prepared the programme for the WG in cooperation with the other WG-leaders and pilot study director. The pilot study director and the WG-leaders form a 'steering committee' for the pilot study.

A final workshop should be more comprehensive and could make use of the input of a NATO Advanced Research workshop, NATO Science for peace projects and other research projects.

At the first workshop four working groups have been installed and for each working group specific questions to be addressed have been formulated. For each working group, a working group leader has been chosen. These working groups continued during the second and the third workshop.

1. Environmental indicators / human health
2. Public participation
3. Transboundary Aspects
4. Goods & Services

1. Environmental indicators / human health

What are the requirements to achieve health objectives? Acute disease, chronic, recoverable?

What parameters must be measured, should be measured, could be measures?

How to define carrying capacity (water use, uptake of pollutants…)?

Linked to the formulation of goals, for what do we need goals?

WG-leader: L. Lavkulich, University of British Columbia, Canada.

2. Public participation

How do we decide who should be involved?

How do we involve the community (the ladder)?

How do we ensure that everyone has the same information and same voice at the table?

Make a comparison of the different systems (e.g. contract de rivière…)

WG-leader: J. van Ast, Erasmus University Rotterdam, the Netherlands

3. Transboundary

How can we derive equitable solutions to transboundary water contamination/withdrawal, risks of inundation?

Can we develop a procedure for developing equitable user pay for contamination/water withdrawal?

How can we divide the resource between different stakeholders (e.g., agriculture – industry), impact of droughts on this division?

Comparison of basin commissions.

WG-leader: G. Roll, Peipsi Center for Transboundary Cooperation, Estonia

4. Goods and services / policy analysis

Valuation of ecosystem services.

Ecological services/policy analysis.

How do we ensure that the right kind of science is done to meet policy objectives?

How do policy makers ensure what the right kind of information is collected (beside allocation of money).

Role and value of floodplains.

WG-leader: M. Fisunoglu, Cukurora University, Turkey.

The second and the third workshop lead to the publication on a book (see par. 7). To compare Integrated Water Management in function of the development of River Basin Management Plans in different basins and / or countries, an outline of a questionnaire has been introduced. Comparison of IWM in different basins / countries in function of the development of

After the third workshop new working groups have been installed: **'Economic valuation'**, **'Technical information and modelling'** en **'Modelling as an integration tool'**. From the fourth workshop on participant should work mainly plenary around given themes. The discussion of these themes supports the development of a questionnaire which will serve as a guideline for River Basin Management Plan cases. To discuss these cases in depth an application for an Advanced Research Workshop of NATO is in preparation. The fifth workshop will fine-tune the themes and the related questionnaire for the ARW. At the sixth workshop the outcomes of the ARW will be prepared for publication.

5 Activities of the fourth workshop

The 4th workshop was held in Lisbon, Portugal, from 2 to 5 March 2005 and organized by Tomaz Dentinho, University of Azores, Terceira, Portugal.

The programme included discussion themes, meetings with local experts and excursion (see detailed programme) attached.

The theme '**Economic valuation'** was organized and coordinated by Tomaz Dentinho, University of Azores, Portugal and Mahir Fisunoglu, Cukurora University, Turkey. The theme '**Technical information**' was prepared and coordinated by Jan Staes, University of Antwerp. The theme '**Computing and modelling as integration tool**' was prepared by Roberto Sacile, University of Genoa, Italy. Tomaz Dentinho prepared also the programme with Portuguese experts.

Objectives

Discussion of the theme economic aspects of IWM, coordinated by Tomaz Dentinho, University of Azores

Discussion of the theme technical aspects of watershed planning and modeling, coordinated by Jan Staes', University of Antwerp

Discussion of the theme computing as integration tool, coordinated by Roberto Sacile, University of Genoa.

Finalization of the INRC publication.

The theme discussions aim to fine-tune the scope of the ARW, related questionnaire and final publication.

Planning of the next workshops and preparation of a NATO Advanced Research Workshop application (ARW).

Main conclusions

Literature shows many examples of plans for particular issues (for instance flood protection, navigation, water quality), but it is more difficult to find information about research and experience on the interactions. With the following workshops and the organization of an Advanced Research Workshop we aim to focus on that interaction. Following questions and topics will lead the discussions for the preparation of the ARW.

What is the role of habitats for water quality?

What is the interaction between quality and quantity, especially at low flows?

What is the interaction of groundwater and surface water?

How can we define the value of the environment, realizing that the value is relative, depending on the situation?

How can the political system being integrated in RBMP?

As stressed at the beginning of the pilot study the main question to be addressed is 'How can we define the carrying capacity' of a system?'

Can differences in Carrying Capacity lead to different impacts?

How to relate scientific information with policy?

Basin management

Trying to provide optimal goods and services

Decide by societal processes to sustain environment and to leave the rest to use

If we do not integrate, ecosystems can not continue to provide goods and services.

What is the impact of management on optimization of goods and services.

Integration of ecological and societal.

From supply management to demand management.

Economic valuation

The presentations and discussion focused on modelling of human behaviour, the differences and comparisons between various valuation systems and the challenge of interdisciplinary valuations.

The theories of different water right systems were illustrated with a situation in situ.

Price of water, or more precisely water system use, cannot be calculated with a static approach. We should realize that models on 'simple' situations can help to understand more complex systems and to support policy, but that to take into account the several exogenous parameters that can play a role, a lot of information is required. When systems are defined we should also deal with the limitation that geographical and human systems do not have the same borders.

Valuation is a tool which we should realize is done by mankind, even the so called according of 'intrinsic value'. As a consequence there is a strong relation between price, perception and education. In the end the value is implicit in the options undertaken by decision makers.

Technical information and modelling

Main topic if discussions are the information that is required for Integrated River Basin Modelling.

Which programming environments are the most suitable for integration of existing models?

A River Basin is approached as a system, but we are confronted with interrelations of systems with different borders f.i human / natural, groundwater, surface water; various phenomenons have different timescales.

Our focus is on the integration of existing models to weigh alternatives; to explore options and combinations; to try to create a framework.

Improving of goods and services will be rewarded in one way or another. To focus on the provisioning of goods and services, we should try to find keys to bring together an ecosystem approach and a socio-economical approach.

If the objective is not quantifiable, you can still model to achieve it. What is the lack of information? What is not achievable?

Goods and service translate into targets.

Important task for next workshop: look for examples of RBMP

Modelling as en integration tool

A lot of discussion topics are strong interrelated with those of the theme technical information. Since for the technical information the focus is on mainly on the nature of information and how to combine it, for the theme modelling the methodology is more central. Which kind of parameters, data and information should be used in function of requested outputs? Different methods and cases have been explained and discussed.

6 Further planning

Workshop	Location	Time
5th	Antalya (Turkey)	November 2005
Advanced Research Workshop	Morocco	April 2006
6th	Poland	June / September 2006

7 Publications and dissemination of contributions and results

Lombardo C., M. Coenen, R. Sacile and P. Meire, 2003 "Integrated Water Management – Pilot Study", Ambasciata d'Italia – Bruxelles - Quaderni Europei N°5, p. 214.
The Italian National Research Council will support a publication, including papers related to the 2nd and the 3rd workshop. It will be published at the beginning of 2005.

Final publication: including the outcome of the Advanced Research Workshop.

Registered participants can make use of a community on Blackboard to facilitate the exchange of texts and comments.

CD-rom with presentations of the 1st workshop.

CD-rom with presentations of the 2nd workshop.

Italian National Research Council Publication

This book (in edition) represents the outcome of the second and the third workshop, respectively held in Genova (Italy) and Värska (Estonia).

The Italian National Research Council (INRC) finances the publication of the book. It contains approximately 200 pages and will be printed in 250 copies. The book consists of three main parts, preceded by a preface of the INRC and by an introduction of the pilot study director and co-director.

Part 1: Concepts of Integrated Water Management*: general presentations of Genova*

Part 2: Basin reports / cases. The cases illustrate the range of issues of water management.

Part 3: reports of the working groups.

Introductory part

Preface, INRC

Towards integrated water management, Patrick Meire, Roberto Sacile, Marleen Coenen

Part 1: Concepts and approaches of integrated water management

Integrated water management in the Mediterranean area, Giorgio Roth

A methodological approach for supporting the development of river basin management plans for the framework directive, Carlo Giupponi

Two key issues in transboundary river management: river restoration and conflict management, Andrea Nardini

Beliefs and preferences influencing participatory decision-making processes, Manuela Pires Rosa

Knowledge discovery in environmental data (hydrological data?), Joaquin Izqierdo

The HELP programme of UNESCO, Michael Bonell

Part 2: Cases

Lake Peipsi case study, Natalia Aleexeeva and Gulnara Roll

Issues of management of the transboundary lake Constance, Jürg Blöch

Schelde nutrient cycling, Tom Cox, Stefan Van Damme, Patrick Meire

Draa River, Morocco, Carmen de Jong

Guadiana River, the Portugese – Spanish transboundary waters, Tomaz Dentinho

Establishment of the Iskar reservoir minimum sanitary storage capacity, Ivanka Dimitrova

Title to be communicated, Phil Jordan

Approaches to Integrated Water Management in Caucasus: the Kura – Aras River Basin Management, Peter Kavelashvili

Impact of Ignalina nuclear power plant on the cooler – lake Druksiai, Jurate Kriauciuniene

Transboundary river contract Semois- Semoy between Belgium (Wallonia) and France, Jérôme Lobet

The Escaut / Schelde transboundary river basin, Eric Masson

Recognition of hydraulic conditions in the upper Narew river system and their influence on the regional development, Dorota Miraslaw

Title to be communicated later, Michela Robba / Roberto Sacile

Nete system analysis, sector participation, Jan Staes and Patrick Meire

Saltwater intrusion in the coastal aquifers of Cervia municipality, Elisa Ulazzi

Part 3: reports of the working groups

Environmental indicators / human health, Les Lavkulich

Participation, Jacko van Ast / Manuela Pires Rosa

Conclusions

Patrick Meire / Roberto Sacile / Marleen Coenen

Final publication

Three main parts

1. IWM in the different basins, to be prepared by each participant

2. To be prepared by ea new working group 'integrated planning and integrated modelling'
3. Concepts on IWM – RBMP: general introduction + input of all working groups

A questionnaire with open questions and key – words is developed. A first survey was presented at the 4th workshop. Comparison and evaluation of the basins will be worked out at the 5th workshop.

8 Preparing the fifth workshop

Participants will look for case studies of IRBM (not on single issues, water bodies, sectors, and disciplines!!!) of which the information requested in the questionnaire can be given. To make comparisons possible cases should be illustrated with pictures, located on geographical maps and clear indicate the issues related to the basin.

For the case studies templates focusing on the required information will be made.

Les will prepare a paper to streamline the frame of the ARW.

Questionnaire should be filled in by 30 September 2005.

The programme of WS5 will be based upon the questionnaires and will be developed in detail in October 2005.

Invitation

Proposal ARW: for ARW in 2006 no dates for deliberation of the applications are available yet.

9 Participating countries

Members of NATO

4th workshop: Belgium, Canada, Estonia, France, Greece, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Spain, Turkey

Previous workshops: Germany, Norway, Slovenia, Sweden, United Kingdom

EAPC partner countries

4th workshop: Georgia

Previous workshops: Moldova

Mediterranean dialogue

4th workshop: Algeria, Morocco, Tunisia

Cooperation with other CCMS pilot studies

Environmental Decision-Making for Sustainable Development in Central Asia.

Cooperation with international organizations

UNESCO - IHP – HELP (Hydrology for the Environment, Life and Policy).

10 References

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Appendices

1. Programme of the fourth workshop
2. List of participants at the fourth workshop