

WORKING PAPER 97

Center Commissioned External Review of IWMI Research Theme 1: Agricultural Water Management

January 2005

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Agricultural Water Management**

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and
Professor Netij Ben-Mechlia*

Reviewers to the Board of Governors of
IWMI and the Trustees of the TATA Foundation

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Preface

In early 2005, the International Water Management Institute (IWMI) commissioned an external review of the institute's Theme 1: Agricultural Water Management. While the name of the theme has changed since its origins in 1996, the overarching objective has remained essentially the same: to contribute to the understanding, development and application of water management strategies at the basin scale that enhance water productivity, food production and livelihoods. To achieve this objective, the theme has concentrated on:

- Improving knowledge on actions and processes to achieve sustainable improvements in water productivity in agriculture;
- Developing and refining tools and methodologies for water resources assessment;
- Identifying, evaluating, and disseminating sustainable options for increasing water productivity, poverty reduction and environmental sustainability;
- Improving the management and performance of irrigation systems; and
- Strengthening the research and institutional capacity of partners to manage water for future food and environmental security at field, system and basin levels.

The key objective of the Center Commission External Review (CCER) was to strengthen the relevance, activities and outreach of the theme's activities and to assist the institute to establish a clear and well targeted medium term research agenda. Specifically, the reviewers were requested to consider:

1. *Past thematic development* and concepts and their practical and policy relevance and impact.
2. The *quality and relevance* of Theme 1 outputs.
3. The *utility and application* of Theme 1 estimates and estimators of water use (e.g., water accounting, the open and closed basin paradigm, and hydronomic zones).
4. The *relevance and capabilities* of the current theme priorities and activities with special reference to remote sensing and modeling related issues.
5. The *future directions and research agenda* in agricultural water management at the broader scale and for irrigation management and technology.
6. Methods of working in *partnership* and suggestions for improvement (e.g., through links to universities and research collaboration with NARES).
7. *Staffing* levels and disciplines.

The review was conducted in January 2005 by two experts:

- Prof. John Langford, Director of Melbourne Water Research Center, Melbourne University, Australia
- Prof. Netij Ben-Mechlia, Director General, INRAT, Tunisia

This Working Paper presents the final CCER report and IWMI's Management Response. These documents, together with the overall program direction, were reviewed and approved by IWMI's Board of Governors during its Program Committee Meeting, held on May 17, 2005 in Tehran, Iran.

Prof. Nobumasa Hatcho,
Program Committee Chair,
IWMI Board of Governors

Dr. Meredith Giordano,
IWMI Research Director

Table of Contents

Part I: Center Commissioned External Review Report	vii
Acknowledgements	vii
Acronyms and Abbreviations	viii
Executive Summary	ix
1. Background and Conduct of CCER	1
2. Overall Assessment Theme 1 Research Output, 1995-2002	2
Relevance and Innovation	2
Scope and Integration of field research	3
The Scaling Issue	3
3. Impact and Contribution to Global Knowledge	4
Concepts	4
Indicators	4
Tools	5
4. Evaluation of Field Activities—Hyderabad, India	5
Methodology	5
Outcome	6
Sustainability	6
Perspectives	7
5. Direction and Scope of Theme 1	7
6. Framework for Future Orientations	13
7. Recommendations	19
Annex 1 CCER program	21
Annex 2 List of documents, management	24
Annex 3 List of Publications	28
Annex 4 Field Visit Itinerary for CCER Review	30
Part II: IWMI Management Response to the CCER Report of IWMI Theme 1	31

Part 1: Centre Commissioned External Review Report

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The CCER Team would like to thank all the staff at IWMI that we interacted with. We were impressed by the positive attitude of the staff, who regarded the Review as an opportunity to improve their ability to make a contribution. This positive organizational culture reflects well on management. The detailed arrangements for the busy schedule of travel, accommodation, meetings, and appointments went like clockwork and allowed us to focus all our attention on the Review.

Professor John Langford and
Professor Netij Ben-Mechlia

Acronyms and Abbreviations

ACIAR	-	Australian Centre for International Agricultural Research
AWM	-	Agricultural Water Management
CA	-	Comprehensive Assessment of Water Management in Agriculture
CCER	-	Center Commissioned External Review
CGIAR	-	Consultative Group on International Agricultural Research
CPWF	-	Challenge Program on Water and Food
EPMR	-	External Program and Management Review
GIS	-	Geographic Information System
ICRISAT	-	International Centre for Research in the Semi Arid Tropics
IWMI	-	International Water Management Institute
NARES	-	National Agricultural Research and Extension Systems
NGO	-	Non-Governmental Organization
RB	-	River Basin
SGPV	-	Standardized Gross Production Value
WHO	-	World Health Organization
WP	-	Water Productivity
WWF	-	Worldwide Fund for Nature

Executive Summary

International Water Management Institute (IWMI) is a robust and healthy organization with a positive approach to change and the future. It has delivered good research outputs. It is heading in the right strategic direction by formulating more focused, theme directed research programs based on a smaller number of larger research projects designed to have beneficial impacts.

Although IWMI has done many good individual research projects, it is as though IWMI has drawn most of the individual pieces of the jigsaw puzzle but there is some hesitation in connecting the pieces to reveal the full picture. The Center for Commissioned External Review (CCER) coming from outside and taking a ‘helicopter view’ can assist in assembling the pieces.

While most of the pieces on the pieces of the puzzle are clear, the focus of Theme 1 is not. IWMI sees itself as a ‘champion of the needed paradigm shift towards: basin scale water productivity; and integration across the complete hydrologic cycle.’ It is difficult to see how, ‘understanding water productivity at the basin scale will achieve the necessary integration. Integration requires taking the perspective of a river basin manager, who must balance the complexities of all stakeholders, not just the agricultural stakeholders. Rapidly growing cities and a deteriorating environment are also important stakeholders in a river basin.

River basin management, for example, requires prediction of hydrological and salinity outcomes of policy and innovations to improve water productivity. It also requires development of water policies and institutions. Policies determining access to water, protection of the integrity of water access entitlements ensuring equity between water users, including those upstream and downstream. Achieving sustainable use of land and water resources is another important challenge for river basin managers. Unsustainable use of water and salinity are two of the greatest threats to achieving sustainable livelihoods. Theme 1 should therefore be focused on ‘Integrated River Basin Management’ and be the vehicle for IWMI to champion integration.

Theme 1 should take the perspective of a water resource or river basin manager, necessarily taking a balanced view across the rural, irrigation, urban, health and environmental stakeholders. The agricultural sector needs a trusted adviser on river basin management because of the opportunities and threats posed to agriculture by basin management, or lack of it. This does not mean IWMI should become expert in urban water supply or ecosystems, but it does need to have a small core of skills that allow formation of partnerships with urban or environmental stakeholders.

Theme 2 would remain essentially as proposed: ‘Increasing Agricultural Water Productivity for Sustainable Livelihoods’ and be the vehicle for IWMI to champion water productivity. Definition and evaluation of water productivity designed for specific circumstances and development of initiatives to improve water productivity would be two major activities for Theme 2. Sustainability and the policy challenges of these initiatives, such as ensuring access and equity, would be carried out by Theme 1 to ensure appropriate checks and balances between integration and water productivity.

A core of IWMI’s research around a set of outcome focused research programs, each containing a portfolio of Theme led research projects, is a good model for IWMI. It would connect the pieces of the jig saw puzzle into a coherent whole.

Contextual research, such as the Comprehensive Assessment of Water Management in Agriculture (CA), can identify the key points of influence, where research and IWMI’s role intersect to give the best opportunities for beneficial and measurable impacts. Investment of intellectual and financial resources in contextual research is vital in developing outcome focused research. Strategic planning and development of each Program should involve all the Theme Leaders and other

stakeholders. Creative links between Theme-based projects could be designed to ensure that the sum of the whole program is greater than the sum of the component projects.

The Knowledge Centre is a vital component in transferring knowledge of IWMI's research to stimulate adoption of the findings and, ultimately, the desired impact.

In the meantime, the Knowledge Centre could synthesize the existing knowledge base and package it for specific audiences. IWMI works largely in Africa and Asia but there are other markets for IWMI's ideas, including the Francophone and Hispanic worlds. The Middle East, North Africa, Latin and South America are all regions that would benefit from the basic understandings flowing from IWMI's research. Such syntheses would also be a valuable contribution to IWMI's strategic planning and partnership building.

BACKGROUND AND CONDUCT OF CCER

The CCER of Theme 1 of IWMI's research portfolio was conducted by Professors John Langford and Netij Ben-Mechlia during the period 10-21 January 2005.

The CCER terms of reference for review of Theme 1 were:

- analysis of the Theme's past accomplishments;
- appraisal of its future strategic orientations; and
- review of the overall integration with other IWMI themes and with the CA and the Challenge Program on Water and Food (CPWF) programs

The reviewers received the necessary scientific documents from the management and were provided with all notes related to ongoing reflections on future administrative structures as well as on Theme 1 orientations.

The CCER work on Theme 1 consisted in the following steps:

- an overall appraisal of the documents received during December 2004 before the effective review started; (a complete list of these documents is presented in Annex 2)
- key questions were raised during the briefing with IWMI management on the first day visit to the IWMI headquarters on 10 January 2005. Additional information was provided to the CCER, principally the "revised memo on Proposed Changes to the IWMI Management Structure";
- after the first meeting with the Theme 1 leader, a series of discussions with IWMI researchers took place at the Institute headquarters;
- attendance at an IWMI research seminar;
- visits to sites in Hyderabad took place during the 15-17 January 2005, and consultation with specialists in ICRISAT (Annex 4); and
- preparation of draft report and its discussion with the management

Theme 1 should be evaluated in the context of IWMI's overall mandate and also with reference to the mission of two important programs hosted by IWMI, namely the CA and the CPWF.

Research accomplishments during 1995-2002 have been evaluated on the basis of selected criteria, specific questions developed as guiding principles by the CCER, namely:

- relevance -Does the research fill a gap in our knowledge?
- innovation - What uses were made from recent technological development? What's new about the methods used?
- scope - Does the Theme 1 research complement other Theme domains and to what extent does it fit within the CA and CPWF programs?

- integration of field research - To what extent were field experiments efficient in feeding the knowledge base? What is the feedback between data collection processes, hypothesis formulation, and verification?
- temporal and geographical scale - What time span and geographical scale are appropriate to crystallize research findings into practical recommendations?

A special focus was dedicated to the analysis of fundamental outputs, and contributions of Theme 1 in shaping the research focus and perception of the water issue in relation to development, namely:

- basic concepts - Are all the elements clear so they can be put together, and have an impact on our thinking and the way that water related poverty issues are portrayed?
- indicators - How good are all the elements in guiding efforts for change? Are aspects linked to poverty alleviation, risk minimization, and livelihood improvement included in the Water Productivity (WP) and Standardized Gross Production Value (SGVP) indexes?
- tools - What is the effectiveness and potential application in water management at local, regional and global scales?

The field visit was an opportunity for the appreciation of the effectiveness of:

- research methodology at the field level;
- quality of experimental outputs;
- adoption of findings at the local scale, linkages with national partners and chances of sustainability; and
- perspectives for generalization and applicability of the lessons to other sites.

The issue of future directions and the shift in regional focus was approached in the light of new documents and clarifications provided by the management during the course of the CCER.

With research impact on ‘poverty alleviation’ in developing countries becoming a central issue in IWMI mandate, particular consideration of this aspect was taken into account during the course of the assessment.

The CCER developed its recommendations after several discussions with IWMI management, researchers and national partners.

OVERALL ASSESSMENT OF THEME 1 RESEARCH OUTPUT 1995-02

The overall objective of Theme 1 is to achieve “optimum use of water at the basin level”

Relevance and Innovation

There is a widely expressed recognition that Theme 1 has generated high quality knowledge. The recognition of world water scarcity together with the focus on water productivity has increased insights into links between water shortages and food problems. Progress is being made on the issue of ‘virtual water’ and food trade at a global level. The issue of ‘virtual water’ could be further developed by examining virtual water balances between production of crops and the point of

consumption. Substantial opportunities exist for improving water productivity by improved harvesting transport, storage, and use of food products.

Innovative methods based on remote sensing and Geographic Information Systems (GIS) have been generated and their potential in resources assessment and the monitoring of managerial intervention have been demonstrated at selected sites. However, they have not yet captured the attention of many users.

Little has been accomplished on the salinity issue and its links to poor management and water scarcity. This is an area where the research output was not strong enough to penetrate decision making circles, where there are concerns over the sustainability of irrigation. Emphasizing global evaluation of the salinity problem will help fill a gap in our knowledge on the different forms of degradation in relation to poor water management practices. Salinity is probably the most serious threat to the irrigated lands of the world, particularly in areas where large populations are affected by both drought and salt.

Scope and Integration of Field Research

The scope of Theme 1 is broad. However, the emphasis seems to reflect an effort to respond to a diversity of issues related to water productivity improvement. In fact most of the work was carried out in response to the widely accepted belief that increasing the productivity of agricultural water will reduce poverty and improve livelihood –which is in a sense fundamental from the perspective that water supply has come to its maximum limit in most poor areas. However, a coherent approach for optimum use of water to improve livelihood and ensure equity starts with giving the poor living in dry areas access to water and protecting those who are living on irrigation from environmental degradation.

The issues of access to water by the poor and environmental degradation have not yet received that attention they require if IWMI's overall mission is to be achieved. The initial focus on physical ways to improve water productivity at regional and basin scales has taken priority. A review of the interactions between improved access to water for the poor and improved water productivity in reducing poverty would be worthwhile.

Integration of field research on water productivity and equitable allocation at different scales would allow Theme1 to be in tune with what is happening on the ground. Building consistent, strong messages on water access in the dry areas and environment protection in irrigated sites is important to earn credibility with different decision makers concerned with alleviating poverty.

The CCER of Theme 1 appreciated the effort made to enhance outputs of benchmark sites for the development of analytical tools, but to achieve the desired impact more involvement of local partners is necessary. National Agricultural Research and Extension Systems (NARES) can be involved as partners for conducting research and facilitating collection of primary data. However, adoption of findings and therefore, ensuring sustainability of the ongoing effort, requires targeting of additional local partners.

The Scaling Issue

The ultimate goal of working on river basins is to translate research findings into a set of technical and institutional solutions. Geographical and temporal scales are therefore chosen in this respect.

An examination of the scaling effect both in terms of hydrology and institutions to determine the aggregate impact of “basin closing” on differential water uses has not been addressed despite its importance.

Historical development of river basins, that is integration of individually small changes over long periods of time, is also a major area that has not been sufficiently integrated into Theme 1. Coherent river basin development as a strategy for enhancing livelihoods cannot ignore the long term impact of small scale interventions on trends in the overall water balance. The historical dimension is particularly important for closing basins.

The IWMI-Theme 1 wide vision of water management at the basin scale has gained widespread recognition. However, the use of indicators and the ways they could be used in strategic planning lack clarity. While it is admitted that the water management issue is rather complex, important improvements in decision making could be achieved if insight is gained in the overall effect of how globalization and climate changes are affecting water resources and food production.

IMPACT AND CONTRIBUTION TO THE GLOBAL KNOWLEDGE

Concepts

The concept of a ‘river basin’ is hard to apply in areas with contrasting wet and dry seasons, where the river may go completely dry during the summer with unpredictable peak discharge following local storms. Optimum management of wadi basins requires the capture of important amounts of water during short periods, using flash floods to control salinity build up and give equitable access to water for population upstream and downstream. The river basins concept must be broadened before it can be applied to irrigated systems in dry areas.

Increasing water productivity at the river basin scale is currently the principal objective of Theme 1. Overall basin optimality and water productivity are straightforward concepts that can help achieve better efficiency in agriculture. Extending the concept to other domains of water use is not simple and cannot be achieved by simply putting money values on various outputs. In many countries the social and environmental values of water cannot be evaluated in terms of dollars. In countries like Egypt, which relies 100 percent on the Nile for its existence, water trade-off between different water users should be based on many considerations, in addition to the commercial value of produced goods.

Hydronomic zoning is a useful concept in understanding the question of water, food and livelihoods in different hydrological settings within the river basin, and requires appropriate tools. Hydronomic zoning has similar shortcomings as the concept of river basins in dry areas, and in areas subject to large interregional water transfers.

Indicators

Water Productivity-- An examination of water productivity of a given crop in terms of yield or in SGVP will show the difficulties of using this concept without due caution. SGVP portrays the “profit” linked to growing a given crop within a particular context. Without knowing the attainable yield within each zone, and for each production system, its use by managers to orient crop diversification within a given region could be misleading for different reasons including, required initial investment, fall of prices, access to markets, etc.

Poor farmers have zero risk bearing capacity and, therefore, cannot accept switching to crops they don't use for their subsistence unless they have some kind of insurance. Even with the crops they are used to growing, they will be reluctant to adopt water productivity if the burden of the proposed action is too heavy, compared to the improvement in their income.

Tools

Models link management options for river basins to the desired outcome. Much of the current work is concerned with case studies attempting to bring together many stakeholders to articulate their needs for better management of a basin. Given the wide range of conditions, a large number of available models have been used. In a sense, Theme 1 one has been successful in showing the complexity of the issues. However, a better impact could be obtained if the modeling effort was more targeted at specific issues, such as accessibility to water and attainable yields for farmers in marginal areas.

EVALUATION OF THE FIELD ACTIVITIES –HYDERABAD, INDIA

The visit was an opportunity for the CCER to appreciate the excellent field work conducted by IWMI in one of its regional centers. The information was gained from interactions with the IWMI researchers and interviews with local partners, including their Principal Secretary in charge of irrigation development. Visiting the research sites, as well as the farms, was crucial in shaping the CCER view on the basic criteria for conducting efficient field work. The following ideas reflect the perception of the CCER of the mission of experimental sites, pointing out where attention should be paid to link field work into the strategic planning of outcome focused research.

Methodology

What methodology is appropriate to allow for an analysis at the basin scale? Targeting problems down from the macro level through sub-basin to field scales is not an easy task. The visit to Hyderabad was very informative in a sense that it strengthened our perceptions of relevant methodological issues. The broad feed back could be synthesized as follows:

- river basins are a good 'laboratory' for experimental work. However jurisdictional boundaries, particularly national borders, can complicate access to data and willingness of basin managers to adopt research findings. Working in sub-basins, where findings are useful for the larger scale, is a good option in such cases.
- Closing river basins face the challenges of adjusting to the stressful reality, and require the development of a long term, dynamic strategy to adapt to increasing stress on water resources. Basins that are moving towards closure are therefore a good research site.
- river basins of a manageable size (3000 Km²), with areas experiencing water scarcity, pollution, irrigation systems management, may offer a clearer view at different scales and are therefore appropriate for leveraging knowledge to larger or smaller scales.

- focus on questions that could be solved in a medium range, (5-10years), is important as it makes possible an input to build on, and at the same time, avoids trivial questions (of daily concern) and elusive issues (50 years ahead).

Outcome

To have an impact, field work from the research perspective needs to be responsive to the following concerns:

- field work that attracts interest from local and regional partners should be selected;
- while the knowledge generated is directed at handling local issues, it should also develop universal rules applicable to other sites;
- synthesis of findings should be carried out from different perspectives to reach a variety of knowledge users; and
- concentrating on a small number of sites to avoid spreading the effort too thinly in an attempt to sample a wide diversity of environments.

Effective knowledge transfer requires coherent clean-cut messages tailored to meet the particular perspective. Feed back from users of research output included:

- messages from research have to come in “packages” connecting water to agriculture and the first concern of the poor—”security”;
- most of the product of small farmers (90% in Hyderabad) is sold on the local market, so any suggested change in the production system should take into account the chain of marketing opportunities, conservation and the associated risks; and
- concerns about environmental issues for closing basins from down stream populations; equity becomes a crucial issue in river basin research.

Sustainability

Experimental work is usually costly and requires input from different partners in order to improve the volume and the quality of research data, on the one hand, and to increase the chances of sustainability and adoption, on the other. International institutions like IWMI ought to have national partners and seek synergy with local researchers, while making sure to keep an independent and objective voice. Local concerns that are linked to key universal issues of poverty need to receive particular attention. Expressed concerns are:

- how to take advantage of globalization, while shaping decisions related to transitions, and protecting the poor?
- is it appropriate to work on water productivity in economical terms without reference to the low risk bearing and investment capacity of the poor? and
- how is the river basin approach applied to interconnected basins?

Perspectives

IWMI will be required to deliver coherent messages to decision makers concerned about water resources development, particularly in Africa, in the coming years. Theme 1 has a large body of knowledge available to draft these messages, pointing to opportunities, and shaping strategic choices for new (to IWMI) sites. Effort to integrate activities at a given site and analyze one strategic issue across different basins is required if Theme 1 is to have an impact on strategic planning. Two essential questions need to draw more attention to the:

- looming danger of climate change in wet areas; and
- extent of salinity in semi-arid environments where rainfall is becoming the only source of fresh water.

Keeping a scientifically based approach is crucial to IWMI and its partners. Messages, for instance, on the consequences of free energy on water depletion, subsidies and poverty alleviation, basin closure and the issue of equity could be very helpful for many countries. In this respect, “negative experiences” are important to document so history will not repeat itself at different places in the world and hurt more disadvantaged people.

DIRECTION AND SCOPE OF THEME 1

Sources

- Draft Strategic Plan 2004 – 2008;
- Medium Term Plan 2005 – 2007;
- Proposed Changes to the IWMI Management Structure dated 23 October 2004;
- Interviews by CCER in January 2005 both in Colombo and in Hyderabad.

Challenge for IWMI

The Plans set out the characteristics of the water challenge and recognize that the specific character of the challenge will vary from region to region:

- physical water scarcity and water stress resulting from limited water resources combined with high and growing demand for water;
- lack of access to reliable and affordable water for the poor, which is considered a key, if not the key, constraint;
- environmental water degradation resulting from high levels of extraction, pollution and poor land management practices; and
- lack of proper management of the world’s water and land resources.

Fundamental Research Question

In order to address these challenges, IWMI has defined an overarching research question:

‘How can we grow more food and sustain rural livelihoods with less water in a manner that is socially acceptable and environmentally sustainable?’

Outcome Focus

IWMI has decided to benchmark its success as a research and knowledge management organization by measuring the impact of its activities achieved by answering this question. In time, an increasing number of case studies should demonstrate that IWMI’s activities have indeed delivered measurable and sustainable improvements in rural livelihoods through better use of water.

To have a measurable impact by optimizing use of water in food production to achieve sustainable management of water resources, IWMI will have to focus its activities on:

- IWMI’s unique role as the water research organization in a network of agricultural research organizations;
- challenges and sites that align significant opportunities for achieving beneficial impacts with IWMI’s research and knowledge management skills;
- challenges where there is strong support from local partners for IWMI’s involvement, and therefore greater opportunities for adoption and ultimately impact;
- work at a scale sufficient to have a substantial impact yet not so large that IWMI’s contribution is so diluted that it cannot be measured;
- rigorous strategic planning supported by contextual research that identifies, evaluates and ranks these opportunities; and
- involving knowledge management specialists from the earliest stages of project planning with the objective of maximizing opportunities for adoption of the out puts.

Research Themes

While the current strategic plans have come a long way in achieving the necessary focus for IWMI’s activities to deliver measurable impacts, more work is required to clarify the proposed research Themes, particularly in water resources management, and to define exactly how these Themes will be used to deliver a portfolio of outcome oriented research projects. Although the focus of this CCER is on Theme 1, the content of all the themes has to be considered to ensure that any changes to Theme 1 are part of a coherent Theme structure.

Our understanding of the role of Themes set out below has been gained from reading the strategic plans, organizational design and discussions with IWMI staff.

The Research Themes are a tool to manage a complex matrix of multidisciplinary, geographically dispersed research projects. The Themes are designed to assemble a set of disciplines and skills to focus on a particular outcome, such as increased water productivity of agriculture, in planning and

delivery of this complex matrix of research projects. The Themes are also important in creating each Theme leader as a champion of 5 important outcomes, namely:

- equitable access to and sustainable use of water and land resources;
- increased water productivity and improved livelihoods;
- improved human health; and
- improved ecosystem health.

Theme leaders will assemble the necessary skills to define and specify a portfolio of research projects related to the Theme and have the lead role in strategic planning. The Theme leaders will control the budgets and oversee delivery of the research projects (as principal of a project agreement or 'contract'). The Regional Offices or Global Research Division, as appropriate, will manage the resources and project delivery. The separation of project definition and delivery is designed to ensure dedication of skilled resources to strategic planning and project definition, which are vital in achieving measurable impacts, and to stimulate collaboration across IWMI.

IWMI's current Strategic Plan covering 2004 – 2008, and the associated Medium Term Plan for 2005 – 2007, set out 5 Research Themes:

1. Agricultural Water Management;
2. Small Holder Land and Water Management;
3. Groundwater Management;
4. Water Resources Institutions and Policies;
5. Water Health and the Environment;

Refocus of the Themes

In October 2004, these 5 Themes were subsequently refocused and reduced to 4 Themes, namely:

1. Understanding Basin Scale Water Productivity;
2. Increasing Water Productivity for Sustainable Livelihoods;
3. Low Quality Water, Livelihoods, Health and Nutrition; and
4. Water, Health, and the Environment.

In developing these 4 new Themes, IWMI sees itself as a 'champion of the needed paradigm shift towards:

- (1) basin scale water productivity; and
- (2) integration across the complete hydrologic cycle ...'.

The CCER has reviewed these developments and concluded that the refocusing of the 5 Research Themes and reduction from 5 to 4 Themes is heading in the right strategic direction but requires further development and clarification of Theme focus and content.

While recognizing the need to focus IWMI's work on water resources and institutional policy on achieving practical outcomes, integrating 'Water resource management and institutions' across the 4 Themes increases the risk of losing the essential focus on integrated water resources management. Sustainability is a vital component of water resources management, which must not be down played by concentrating on water productivity. Integration across the complete hydrological cycle, including environmental water management, should have a focus of its own. Indeed such a focus on basin level water resources and sustainability is required for IWMI to become a 'champion of integration across the complete hydrologic cycle'.

The CCER recommends that Theme 1 becomes: 'Integrated River Basin Management'.

IWMI, as a primarily agricultural research organization, is in a difficult position having to assume the perspective of the basin manager, who must consider all stakeholders, and not just the agricultural sector. However, the agricultural sector needs to understand the potential conflicts and constraints agricultural activities might face from other stakeholders in a river basin. Improving water productivity involves changing the water balance of river basins and affecting access to water between groups of agricultural stakeholders, cities and the environment. There needs to be a group within the agricultural sector that understands these conflicts and constraints, and, more importantly, can develop solutions that reduce the impact of these constraints on agriculture. IWMI is in an ideal position to be the intelligent advisor of the international agricultural sector.

Taking a basin wide perspective does not mean developing detailed knowledge and research on urban water supply and wastewater management. The cities could be considered as a customer for bulk water supplies, a source of bulk wastewater for agriculture to use, and an influence on rural communities that live in close proximity.

Environmental considerations can be a substantial constraint on agriculture. Irrigation is a case in point. The agricultural sector needs a research group that has sufficient skills and credibility with environmental stakeholders to build partnerships and stimulate research into practical ways for agriculture to reduce its impact on aquatic ecosystems.

Integration of groundwater with surface water management is a logical step because they are often interconnected and must be managed as components of the one resource. In any event, surface and groundwater must be considered together to achieve integration across the hydrologic cycle. Groundwater management should be part of Theme 1.

The initial step of combining small (farm) and large (irrigation system) scale initiatives to increase water productivity is well founded because the two often interact. Improvements in operation of an irrigation system, such as supplying water on demand or improving reliability of supply, create substantial opportunities for improved water productivity on irrigation farms. Water productivity is a difficult issue to address because water is only one input into complex agricultural enterprises and can be affected by activities that appear to have nothing to do with water, such as increasing stocking rates or applying fertilizer. Having a theme (Theme 2) with a strong focus on agricultural water productivity, as envisaged in the latest strategic paper, is therefore vital.

Theme 2 should include water productivity through the full continuum from rain fed agriculture, to on-site water harvesting and local irrigation, all the way to complex, large scale, multi basin intensive irrigation schemes. Rain fed agriculture must be included with irrigation schemes because both can change the water balance of river basins. Replacing deep rooted forests with shallow rooted crops or replacing annual with perennial pasture can have profound effects on the water balance of

river basins if applied to a substantial portion of the basin. The CCER recommends that Theme 2 be: ‘Increasing Agricultural Water Productivity for Sustainable Livelihoods’.

Water productivity at a basin scale must now be considered. Working at a river basin scale requires working with all the stakeholders in the basin including cities, hydropower and the environment to name three. Equity must also be considered. For example, the most effective way to increase overall water productivity in a particular river basin might involve concentrating water use in the upstream portion of the basin. Redirecting water to upstream stakeholders should not be implemented without taking equity issues into account by considering the effects on downstream water users. Agricultural water productivity at a basin scale must be addressed as a component of integrated river basin management because it requires consideration of all stakeholders, not just the agricultural stakeholders, and must address equity issues. In order to illustrate the point, the ACIAR project: ‘Water Allocation in the Krishna River Basin to Improve Water Productivity in Agriculture’, would be developed under Theme 1.

Increasing water use and ‘closing river basins’ increase the risk of salinization of productive agricultural land with disastrous consequences for water productivity. Research suggests that roughly one third of the world’s irrigated land is affected or vulnerable to irrigation induced salinity. Salinity is therefore a substantial threat to sustainable rural livelihoods. IWMI could work towards development of strategies both to reduce the risk of future problems and to live with existing salinization. IWMI’s knowledge management role could make an important contribution in communicating with decision makers, motivating them to take action. Salinity is not an issue that can be ignored. Salinity could be addressed at the basin scale in Theme 1 and at a farm scale in Theme 2 or it could be separated and elevated as a new Theme

The CCER therefore recommends that both irrigation and dry land salinity be given more attention by IWMI.

The revised Theme 3 is ‘Low Quality Water, Livelihoods Health and Nutrition’. The focus of this Theme is to evaluate how low quality water impacts on livelihoods, health and nutrition. However, urban wastewater also presents agriculture with an opportunity, because it provides a highly reliable nutrient rich source of water. The Theme should consider how urban wastewater can be protected from unnecessary pollution. Trade waste policies that protect urban wastewater from toxic or saline inputs should be a subject of concern to IWMI.

The proposed revision of Theme 4 to: ‘Water, Health, and the Environment’, is an excellent development of the theme structure. Protecting health and the environment are two fundamental components of water management. Although IWMI does not have a central role, it should continue selective involvement in both areas so that it can be an ‘intelligent partner’ with organizations such as World Health Organization (WHO) or the Worldwide Fund for Nature (WWF). In any event, integrated water resources management requires skills in environmental water management. The CCER recommends Theme 4 should be as proposed: ‘Water, Health, and the Environment’.

Compatibility between Theme 1 and Theme 2

Theme 1: Integrated River Basin Management

This Theme would have the essential role of integration across the water cycle, including quality and quantity, to achieve sustainable water use. Theme 1 would take the perspective of a water resource or river basin manager necessarily, taking a balanced view across the rural, irrigation, urban, health and environmental stakeholders.

Theme 1 would include:

- **Prediction and development of scenarios at a basin scale** through hydrologic and water quality modeling across the hydrologic cycle (surface and ground water resources). The consequences of initiatives to increase water productivity would be a major component of the hydrologic modeling, including scenarios based on reallocating water between hydronomic zones to increase water productivity.
- **Water (allocation) policy and institutions** addressing bulk water allocation, water entitlements for farmers, cities and the environment. Water accounting and inventory are important components of water allocation policy. Access to water by the poor and protection of the integrity of all water access entitlements is important in achieving equity. Policies and scenarios for reallocation of water between irrigators, hydronomic zones, and between irrigation and growing cities, would be a significant component of this work.
- **Management of salinity at a river basin scale;**
- **Social policies relevant to reduction of poverty** including the interaction between agricultural water productivity and reduction of poverty
- **Bulk water systems** and inter-basin transfers
- **Policies for funding renewal and reconfiguration** of irrigation districts
- **River basin management**, including institutional structures for achieving integrated management of complex river basins, (including multi jurisdictional river basins)

Theme 2: Increasing Agricultural Water Productivity for Sustainable Livelihoods

Increasing water productivity at all levels and for all uses is vital to achieving sustainable use of water resources. Building a single Theme with a strong focus on agricultural water productivity will ensure that water productivity has a champion. There are strong interactions between water productivity at basin, irrigation district and farm scales. This Theme would take the perspective of agricultural stakeholders. In order to ensure compatibility with the recommended Theme 1, Theme 2 would include

- definition and evaluation of water productivity, which must reflect the application of the concept to different circumstances;
- investigation of the full range of options for improving water productivity of agricultural enterprises, (including non water related options), over the full range of scales from rain fed agriculture, through on-site water harvesting for local irrigation, to community scale irrigation and ultimately to large scale intensive irrigation schemes. Reviewing the continuum of scales should identify the optimum scale for agricultural enterprises in particular environments to improve water productivity. This research could be defined as contextual research to identify the most promising options for detailed investigation.

- Evaluation of the economic, environmental and social consequences of the most promising options (for the relevant management unit, farm, community or region) in a form compatible for input to basin wide hydrological, economic and environmental models. The evaluation should include water, salt, nutrient and contaminant balances. Energy requirements, such as electricity consumption for pumping, should be included in the environmental evaluation.
- Management of salinity at a farm scale.

FRAMEWORK FOR FUTURE ORIENTATIONS

Overall Strategy

IWMI is heading in the right strategic direction in formulating more focused, theme directed research programs based on a smaller number of larger research projects designed to have beneficial impacts. It is as though IWMI has drawn most of the pieces of the jig saw puzzle but there is some hesitation in connecting the pieces to reveal the full picture. The CCER coming from the outside and taking a ‘helicopter view’ can assist in assembling the pieces.

In assembling the full picture, the following pieces of the puzzle must be assembled:

- links to the CA, and the CPWF;
- themes to integrate disciplines and perspectives;
- outcome focused core research programs;
- matrix of programs and themes;
- core funding for strategic outcome focused research programs;
- contextual research to guide strategic planning;
- strategic planning;
- synchronization of core research programs; and
- management accountabilities and project agreements.

After assembling these pieces, the best way of describing the full picture is by illustration. The research programs and Theme based projects used in this illustration are not intended to define the content of any ultimate core research portfolio.

Comprehensive Assessment and Challenge Program

IWMI is already involved in two outcome focused research programs:

- Comprehensive Assessment of Water Management in Agriculture; and
- Challenge Program on Water and Food.

The CA takes stock of the costs, benefits and impacts of the past 50 years of water development for agriculture, the water management challenges communities are facing today and

the solutions people have developed. The results of the Assessment will enable farming communities, governments and donors to make more cost effective investment and management decisions. An initiative of the CGIAR, the CA is convened by IWMI and involves other partners on specific projects, as appropriate.

The CPWF is an international research and capacity building initiative to find ways of growing more food with less water, while improving rural livelihoods and protecting the environment. The Challenge Program is managed by a 19 member consortium of partners tapping the specific strengths of each. The partners come under the following categories:

- CGIAR Future Harvest Centers;
- NARES;
- Advanced Research Institutes;
- International River Basin Organizations; and
- NGOs.

The CPWF is guided by 5 Research Themes:

- Global and National Food Systems;
- Integrated Basin Water Management Systems;
- Aquatic Ecosystems and Fisheries;
- Water and People in Catchments; and
- Crop Water Productivity Improvement.

The leader of the 'Integrated Basin Water Management Systems' Theme is Francis Gichuki from IWMI.

The CPWF has selected nine 'Benchmark Basins' creating a matrix of Themes and 'Benchmark Basins' to organize the research. Six of the 9 Benchmark Basins are international transboundary basins, shared by two or more countries. The Benchmark Basins are:

- Yellow River;
- Indo-Gangetic;
- Limpopo;
- Mekong;
- Nile;
- Karkheh;
- Sao Francisco;
- Volta; and
- Andean Basins.

The CPWF is using a competitive process to select projects. In October 2003, a portfolio of 50 projects was selected from the first competitive call for project proposals. These projects are

being funded on a priority basis as funds become available. The CPWF is a large, complex and ambitious research and knowledge exchange initiative.

IWMI has a strong involvement in both the CA and the CPWF and IWMI's core research programs will have to be carefully matched to avoid duplication and ensure mutually beneficial outcomes. IWMI's core research should be designed to dovetail with these two important research programs. These two programs also give IWMI insights into the design of its core research.

Themes to Integrate Disciplines

The research themes are a tool to manage a complex matrix of multi disciplinary, geographically dispersed research projects. The Themes are designed to assemble a set of disciplines and skills to focus on particular outcomes, namely:

- equitable access and sustainable use of water and land resources;
- increased water productivity and improved livelihoods;
- reduced risk of salinity and cost effective rehabilitation;
- improved human health; and
- improved ecosystem health.

In order to achieve impact on, for example, reduction of poverty in Africa, all 4 Themes will have to be organized to deliver component projects that build on each other, creating an outcome focused program of research to achieve the desired impact.

Outcome Focused Core Research Programs

The concept of outcome focused research programs is not new to IWMI. Organization of the core research around a set of outcome focused research programs, each containing a portfolio of Theme led research projects, is a good model for IWMI. Strategic planning and development of each Program should involve all the Theme Leaders and other stakeholders. Creative links between Theme based projects could be designed to ensure that the sum of the whole program is greater than the sum of the component projects.

The outcome should define the impact IWMI intends to achieve. Two illustrative outcomes are:

- reduction of poverty in Africa through innovative use of water resources; or
- sustainable rural livelihoods, while providing reliable water supplies to rapidly growing cities in Asia.

The outcome should be developed in partnership with the potential 'clients' of the research, that is local partners who are living with the problem and who have a strong interest in achieving the outcome. In order to have an impact, those who can make an impact through action 'on the ground' must be involved from the conception of the program.

Matrix of Outcomes and Themes

The Themes of the matrix would provide the rows of the matrix and the outcome or client focused research programs would make up the columns. The Themes would ensure that the important perspectives of integrated river basin management, increased agricultural water productivity, salinity and human and ecosystem health are given due emphasis in the core research programs. The Programs would ensure an outcome or client focus of IWMI's core research.

The matrix would be 'patchy', because there may be no need to populate all the elements of the matrix.

Core Funding

Allocation of a proportion of the core budget of IWMI (from sources under IWMI's control) to fund core, outcome focused research programs giving IWMI a strong voice in selecting partners and in organizing collaboration to the benefit of IWMI's essential interests. There are some 60 projects that will be completed over the next 2 to 3 years, giving time for thorough strategic planning to prepare a set of core outcome focused research programs. Programs can be progressively implemented as current projects wind up and funds become available.

IWMI's overall portfolio of research would then comprise:

- core outcome focused research programs initiated by IWMI;
- programs and projects commissioned by funding partners; and
- interest driven research contributing to intellectual capital.

IWMI should avoid becoming a contract research provider. There would be a significant risk of the organization losing influence over the strategic direction of water research in agriculture. IWMI should take the lead in initiating and implementing core research programs to fill the vital role of water management across agriculture and the interactions between agriculture and the other stakeholders in river basins.

Contextual Research

Contextual research is an essential prerequisite for establishing an outcome focused research program. Indeed, contextual research is essential in selecting the desired project outcomes. Contextual research can identify the key points of influence where research and IWMI's role intersect to give the best opportunities for beneficial and measurable impacts. Investment of intellect and financial resources in contextual research is vital in developing outcome focused research.

IWMI has recognized the importance of contextual research by investing in the CA, which provides a mine of information for guiding IWMI in selection of the outcomes and identifying the points of influence. The synthesis of information and contextual research has not been completed. The first step in strategic planning would be to prepare a preliminary draft of the synthesis of the CA program to date.

Strategic Planning

The strategic planning should be led by the Director of Research supported by the 4 Theme Leaders. Involvement of discipline leaders from the Global Research Division, the Knowledge Centre and Regional Directors is also essential. Leaders of the CA and the CPWF should also be involved to ensure best use of contextual research and a good fit with the research in the CPWF.

A map of stakeholders should be prepared to identify the 'clients' or partners for the outcome based research programs. 'Clients' in the regions are vital, because they have the potential to take up and implement the findings of IWMI research. Partnerships with potential 'clients' should be developed early in the planning process to ensure that the research meets the latter's needs.

All the research projects in the core research program should be synchronized to manage the inevitable interactions between projects, Themes and programs.

Links to the Challenge Program

IWMI is involved in half the 30 funded projects in the CPWF and is leading 7 projects. Given this substantial involvement and the conceptually similar approach between the proposed IWMI core research and the CPWF, possible linkages and conflicts should be assessed. At the most, the CPWF projects have only been in progress for 6 months and will not deliver the first synthesis of results until October 2006 at the earliest. The projects are currently scheduled to be completed in 2008.

Collaboration on contextual research to identify strategic issues and points of influence would be mutually beneficial. The absence of any commercial interests allows full collaboration. Currently, the CPWF is developing a set of 'Basin Focal Projects', essentially contextual research in their Benchmark Basins to better target future research. The outcomes of these 'Basin Focal Projects' should be used together with the synthesis of the CA to better target IWMI's core research programs.

The CPWF is based on publication of project brief, a call for proposals and competitive selection of projects. The proposed approach to IWMI's core research involves custom built research projects based on strategies crafted from contextual research, using largely internal resources. The CPWF could be seen as another column in the matrix of themes and outcome focused projects.

Apart from close collaboration on contextual research, it is difficult to see a closer integration of IWMI core research and the CPWF without creating unacceptable transaction costs. Currently, there is sufficient involvement of IWMI staff to avoid duplication of effort or dysfunctional behavior. Indeed, implementation of two parallel but different approaches to provide answers to the same question is an effective strategy for discovering the best answers!

Accountabilities

Strategic planning should be under the direction of the newly created Director of Research. Theme leaders would manage the core projects within their Theme and provide program leadership as appropriate.

Project Agreements should be drawn up with all the discipline that would be required for an external research provider. The Project Agreements would define budgets, milestones and timelines in addition to detailed specifications of the research and resource inputs by the various organizational units in IWMI. Experience in managing complex multi disciplinary research projects across organizational units requires such discipline to succeed.

‘Laboratory Basins’

In order to test concepts, model water scenarios, take measurements and test hypotheses field sites are required for the research. Since river basins are the unit for water management, study concepts such as ‘Focus Catchments’ or ‘Benchmark Basins’ have been developed. Despite its advantages, selecting Benchmark Basins can send a message to stakeholders outside these Benchmark Basins that you are not interested in working in their region.

Developing research programs designed to have application over a wide range of regions and selecting ‘Laboratory Basins’ to sample and test hypotheses in different conditions could be a useful development. The term ‘Laboratory Basin’ might convey the message that these Basins are laboratories, where concepts and models can be tested in readiness for more widespread application.

Currently, there are 3 sets of Benchmark Basins selected for:

- Comprehensive Assessment;
- Challenge Program; and
- IWMI (currently 4 Benchmark Basins).

While there is no fundamental issue in using 3 sets of Benchmark Basins, well defined criteria for selecting basins would reduce the appearance of some confusion.

Illustration of the Matrix of Core Research Themes and Programs

	Program 1 Poverty in Africa	Program 2 Stressed River Basins in Asia	...Program X
Outcome	Reduction of poverty in Africa through innovative use of water resources	Sustainable rural livelihoods, while providing reliable water supplies to rapidly growing cities in Asia	
Theme 2 Increasing Agricultural Water Productivity for Sustainable Livelihoods	Project 1.1 Identify the most prospective forms of rain fed or irrigation that reduce poverty through water productivity	Project 2.1 Improving farm water productivity Project 2 Recycling urban wastewater	
Theme 1 Integrated River Basin Management	Project 1.2 Model hydrological and water quality scenarios for the ‘laboratory basin(s)’ Project 1.3 Design the most effective water policy frameworks to ensure equitable access to water	Project 2.2 Model Hydrological and water quality scenarios for water productivity in ‘laboratory basin(s)’ Project 2.3 Design a water allocation policy that allows transfer of water between agriculture & cities	
Theme 4 Water, Health, and the Environment	Project 1.4 Environmental risk assessment	Project 2.4 Health risk assessment and development of protective measures Project 2 Environmental Risk Assessment	
Knowledge Centre	Stimulation of adoption of the research findings	Stimulation of adoption of the research findings	

RECOMMENDATIONS

The CCER recommends that:

1. **IWMI research on virtual water at a global scale be extended to regional and local scale** to examine the potential for improvements in water productivity achieved from more efficient harvesting, transport, storage and use of food products in the developing world.
2. **Theme 1 becomes ‘Integrated River Basin Management’** encompassing:
 - prediction and development of scenarios at a basin level;
 - water (allocation, access, and equity) policy and institutions;
 - management of salinity at a river basin scale;
 - social policies relevant to reduction of poverty;
 - bulk water systems;
 - policies for funding renewal and reconfiguration; and
 - river basin management.

Theme 1 has the essential role of integration across the water cycle, including quality and quantity, to achieve sustainable water and land use. Theme 1 would take the perspective of a water resource or river basin manager, necessarily taking a balanced view across the rural, irrigation, urban, health and environmental stakeholders. The agricultural sector needs a trusted adviser on river basin management because of the opportunities and threats posed by to agriculture by basin management, or lack of it.

3. **Theme 2 becomes ‘Increasing Agricultural Water Productivity for Sustainable Livelihoods’** encompassing:
 - definition and evaluation of water productivity;
 - investigation of the full range of options for improving water productivity;
 - evaluation of the economic, environmental and social consequences; and
 - management of salinity at a farm scale.

Theme 2 has the essential role of driving agricultural water productivity to reduce poverty and to increase the economic value of water use. The initiative developed by Theme 2 would be examined in a river basin context by Theme 1 to provide checks and balances to ensure that the proposals are sustainable.

4. **Irrigation and dry land salinity be given more attention by IWMI** either as part of Themes 1 & 2 or a restructured Theme 3.
5. **IWMI use contextual research developed by the CA, and the Basin Focal Projects of the CPWF, among other sources to inform strategic planning** and selection of program outcomes and scope of research projects. To this end, a preliminary synthesis of the CA to date would be beneficial.

6. **IWMI focus its strategic planning on identifying research programs and projects that take advantage of:**

- IWMI's unique role as the water research organization in a network of agricultural research organizations;
- challenges and sites that align significant opportunities for achieving beneficial impacts with IWMI's research and knowledge management skills;
- challenges where there is strong support from local partners for IWMI's involvement and therefore greater opportunities for adoption and ultimately impact;
- working at a scale sufficient to have a substantial impact yet not so large that IWMI's contribution is diluted and cannot be measured; and
- involving knowledge management specialists from the earliest stages of project planning with the objective of maximizing opportunities for adoption of the research outputs.

7. **IWMI establish a set of core outcome focused research programs**, supported by the discipline and perspective of the research themes in creating a matrix of projects designed to maximize IWMI's potential to have beneficial impacts.

Use of clearly defined outcomes for the core research programs will help draw the pieces of the jig saw puzzle together, creating a coherent view of the research both for communicating with stakeholders and motivating staff.

8. **IWMI's Knowledge Centre should synthesize the research output in forms tailor made for specific audiences.**

IWMI works largely in Africa and Asia but there are other markets for IWMI's ideas, including the Francophone and Hispanic worlds. The Middle East, North Africa, Latin and South America are all regions that would benefit from the basic understandings flowing from IWMI's research. Such syntheses would be another valuable contribution to IWMI's strategic planning.

**CCER PROGRAM WITH PROFS. JOHN LANGFORD AND NETIJ BEN-MECHLIA
FROM 10 TO 21 JANUARY 2005**

Date	Time	Meeting	Designation	Location	Remarks
10 th January (Monday)	09:00	Frank Rijsberman	Director General	DG's Meeting Room	
	10:00	Hugh Turrall	Theme Leader 1	Ganges Room	
	10:15	Meredith Giordano	Director, Research	MG's Room (1201)	
	14:00	Hugh Turrall	Theme Leader 1	Ganges Room	
		Background reading			
11 th January (Tuesday)		Background reading			
	10:00	Robert Zomer	Senior Landscape Ecologist		
	11:00	Prasad Thenkabail	Head, RS-GIS lab, GRD	Visit to GIS/RS Lab	
	14:00	Mark Giordano	Head, Institutions & Policies	MG's room (2224)	
	15:30	Jonathan Woolley	Coordinator, Challenge Prog.	JW's room (2325)	
12 th January (Wednesday)	09:00	David Molden	Leader, Comprehensive Assessment	DM's room (2210)	
	10:15	François Molle	Water Management Specialist	FM's room (2207)	
		Background reading			
	14:00	Deborah Bossio	Theme Leader 2	Ganges Room	
	15:15	Francis Gichuki	Theme Leader 4, Challenge Programme	FG's room (2209)	
	19:00	Drinks at the Pub – hosted by Frank Rijsberman		(Hilton Hotel)	
13 th January (Thursday)	09:00	Nicholas Roost	Irrigation and Water Management Specialist	Ganges Room	
	10:15	Mobin-ud-Din	Hydrologist and Remote Sensing Specialist	Ganges Room	
		Background reading			
	14:00	David Molden	Leader Comprehensive Assessment	Ganges Room	Environmental work at IWMI
	15:15	Charlotte de Fraiture	Modeler	Ganges Room	Global trade/water

(Continued)

**CCER PROGRAM WITH PROFS. JOHN LANGFORD AND NETIJ BEN-MECHLIA
FROM 10 TO 21 JANUARY 2005 (CONTINUED).**

Date	Time	Meeting	Designation	Location	Remarks
14 th January (Friday)	09:45	Julie van der Blik	Global Research Director	JvB's Room (2106)	Knowledge Center Initiative
	10:15	Upali Amarasinghe	Senior Statistician	Ganges Room	
		Background reading			
	14:00	Frank Rijsberman	Director General	DG's meeting room	
	15:15	Prasad Thenkabail	Head, RS-GIS lab, GRD	Ganges Room	
15 th January (Saturday)	F R E E	D A Y			
16 th January (Sunday)	03:50	Leave for Hyderabad	Pick up from Hilton 0350 hrs UL 175 – CMB/Hyderabad – 0650/0820		
	AM	Straight from Airport	Visit to Musi River wastewater irrigated area	Accommodation: ICRISAT Campus Patancheru - 502324 A.P. India Tel : +91 4023 296161 Fax: +91 8455 282829	
	PM	To be completed by 3 p.m. Visit to Osman Sagar Reservoir			
17 th January (Monday)	AM	Meeting with Chris Scott (Regional Director), Trent Biggs (Post Doc), Anju Gaur (Researcher) Presentation on past and continuing work. (TB: Krishna river basin water balance CS: Overview of activities in India.)			
	PM	Meeting with partner/s: Jawaharlal Nehru Technological University; AP Principal Irrigation Secretary, CVSK Sarma (to be confirmed?)			

(Continued)

**CCER PROGRAM WITH PROFS. JOHN LANGFORD AND NETIJ BEN-MECHLIA
FROM 10 TO 21 JANUARY 2005 (CONTINUED).**

Date	Time	Meeting	Designation	Location	Remarks
18 th January (Tuesday)	AM	Meeting with ICRISAT watershed group.			
	PM	Site visit to Maheshwaram on watershed and groundwater development (with NGO partner, IRDAS). Teleconference with AP Principal Irrigation Secretary (Water Management), S.P. Tucker			
	18:00	Leave for Colombo	Pick up from ICRISAT UL 176 –Hyderabad/CMB– 2100/2330		
	23.30	Arrival in Colombo	Taken to Hilton		
19 – 20 January	AM				
	14 :30	Jonathan Woolley	Coordinator, Challenge Prog.	JW's room (2325)	
21 st January	13:30	Closing meeting with Frank, Hugh & Meredith and discussion of CCER report		DG's Meeting Room	

Terms of Reference for a Center Commissioned External Review (CCER) of IWMI Theme 1—Agricultural Water Management

BACKGROUND

IWMI, based in Colombo, Sri Lanka, conducts public goods research and capacity building activities related to water and land management, with the goal of improving food security, livelihoods, and the natural environment in developing countries. By working with its diverse partners and the Future Harvest centers of the Consultative Group on International Agricultural Research (CGIAR), IWMI is creating innovative approaches to translate natural resource management research into actionable recommendations for policymakers, resource managers and poor rural communities.

IWMI's overarching research question is: *How can we grow more food and sustain rural livelihoods with less water in a manner that is socially acceptable and environmentally sustainable?* To effectively respond to this question, IWMI has organized its research around five research themes, namely Agricultural Water Management; Smallholder Land and Water Management; Groundwater Management; Water Resources Policies and Institutions; and Water, Health and Environment.

Theme 1 has been at the centre of IWMI's work on irrigation management since the mid-1990s, at which time the institute broadened its focus to consider the place of agricultural water management within the larger contexts of the river basin and integrated water resources management. As such, the theme has been the vehicle for IWMI's development of work on water accounting, hydronic zones, water productivity and the application of integrated modeling approaches to these issues. The theme has also been involved in the development of remote sensing and GIS applications in agricultural water management, in conjunction with a number of key partners in academia and on the ground. These tools support the work of all IWMI Themes as well as the research carried out in IWMI's Benchmark Basins. These basins are IWMI's field laboratories, where research under all themes is concentrated in a particular basin and where data, understanding and partnerships can be consolidated. IWMI has four benchmark 'basins' – Ruhuna (in Sri Lanka), Olifants (in South Africa), Rechna Doab (Pakistan) and Krishna (in India).

Theme 1 contains a mix of global, regional, basin and finer-scale perspectives and activities, and the medium-term priorities are set out in the recently published Strategic Plan for 2004-2008. The theme has championed the change in focus from IIMI (International Irrigation Management Institute) to IWMI (International Water Management Institute) and has seen much conceptual development up to 2003. The theme must now look forward to consolidating and operationalizing these developments, while at the same time looking forward to new challenges and generating new thinking on key global, regional and basin level issues.

The Review

The key **objectives** of the review will be to strengthen the relevance, activities and outreach of Theme 1 work and assist it to set out a clear and well targeted medium term research agenda.

IWMI will review the activities of the research program in Theme 1 “Agricultural Water Management” (AWM), formerly “Integrated Water Management for Agriculture” in early 2005. The review will cover the period from 1995-2004, as summarized in the recent synthesis paper, authored by Drs. Hammond Murray-Rust and Hugh Turrall.

Two international experts will review the Theme and its activities by visiting IWMI, Colombo, for discussion with key members of the Theme and the management team.

The review will be overseen by the IWMI Program Office and the Director General, and the results will be presented to the IWMI Board in May 2005 and a formal statement on its findings will be made by IWMI management as appropriate.

IWMI will collate and provide all appropriate documentation and publications well in advance of the review.

The reviewers will:

1. Prepare for the conduct of the review by reading all background information provided by IWMI. (This may include CGIAR documents, IWMI plans and reports, and other publications relevant to the area being reviewed, e.g., project proposals and reports, Memoranda and Letters of Agreement, staff lists and other documents as appropriate etc.)
2. Contact international partners and national counterparts to obtain their views on IWMI’s work in the field of Agricultural Water Management, their perspective on collaborative activities and their interests in terms of future directions of the program.
3. Travel to IWMI headquarters to meet key staff and discuss and review the major activities of the theme.
4. Analyze the status and trends in the resource flow through the Agricultural Water Management and report on its success in mobilizing resources, its effectiveness in spending resources, and its efficiency in managing the resource flow as compared to other IWMI programs and international research standards.
5. Draft a written report within the time of the visit to the headquarters, which should be provided to the review convener before panel members depart. It should include both an ex-post evaluation as well as a proposed updated research agenda.
6. Submit a full written report to the IWMI Director General within two weeks of the concluding the visit. The CCER reports should gauge the effectiveness and relevance of science to the field and IWMI’s mandate, staff capacity and management, partnership arrangements, quality of publications, relevance of outputs and the efficiency of their delivery to target audiences, the adequacy of funding and the plans for future research and development.

More specifically, the team will consider:

7. Past thematic development and concepts and their practical and policy relevance and impact.
8. The quality and relevance of IWMI outputs:

- a. Peer reviewed journal articles
 - b. Research Reports and Working Papers
 - c. Other products
9. Utility and application of Theme 1 estimates and estimators of water use – water accounting, the open and closed basin paradigm, hydronomic zones etc.
 10. Relevance and capabilities of the current activities: with special reference to remote sensing and modeling related issues such as
 - a. the development of a modeling group at IWMI
 - b. water quality considerations
 - c. application of appropriate and improved techniques in hydrological analysis
 11. The future directions and research agenda in agricultural water management at the broader scale and for irrigation management and technology.
 - a. sustainable management of public infrastructure;
 - b. public-private partnerships in water management (non-institutional aspects);
 - c. management of irrigated agriculture to minimize environmental externalities; and
 - d. better understanding and management of surface: groundwater interactions.
 12. Methods of working in partnership and suggestions for improvement – e.g., through links to universities and research collaboration with NARES.
 13. Staffing levels and disciplines.
 14. The relative importance of the Agricultural Water Management sub-themes and their focus, with respect to:
 - a. water resources and irrigation;
 - b. blue water; green water (irrigated versus rain fed development and management);
 - c. global to basin – balance between strategic global issues (changing irrigation and agricultural water management in the face of accelerated urban and industrial development; climate change impacts; water storage and supply security) compared to more directly practical research on basin level water management for agriculture.
 - d. local level (action) research.

IWMI will:

1. Develop contracts and the logistics for the conduct of the review by the chosen expert.
2. Provide all relevant background information and assist in the orderly conduct of the review through allowing time for adequate preparation by staff, persons to be visited etc.

3. Share the expert's draft or final report, at the discretion of the DG, with program or project staff and formulate Management's draft response to the major findings and recommendations of the panel's report.
4. Present the findings of the review and the report document to the immediately subsequent meeting of the Board of Trustees, and finalize Management's commentary to the report on the basis of agreed issues.
5. Communicate IWMI's response to the CCER expert/panel, and retain both the report and the response for later use by the CGIAR Science Council convened EPMR.
6. Implement any agreed changes to program activities in the light of the CCER review.

List of Publications for CCER Review

1. Bakker, M; Barker, R; Meinzen-Dick, R and Konradsen, F. (Eds.) 1999. *Multiple uses of water in irrigated areas: A case study from Sri Lanka*. Colombo, Sri Lanka: IIMI. (SWIM paper 8)
2. Bastiaanssen, W. G. M.; Molden, D. J.; Thiruvengadachari, S.; Smit, A. A. M. F. R.; Mutuwatte, L. and Jayasinghe, G. 1999. *Remote sensing and hydrologic models for performance assessment in Sirsa Irrigation Circle, India*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 27)
3. Bastiaanssen, W. G. M. 1998. *Remote sensing in water resources management: The state of the art*. Colombo, Sri Lanka: IWMI.
4. Droogers, P. 2002. *Global irrigated area mapping: Overview and recommendations*. Colombo, Sri Lanka: IWMI. (IWMI working paper 36)
5. Droogers, P. and Kite, G. 2001. *Estimating productivity of water at different spatial scales using simulation modeling*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 53)
6. McKinney, D. C.; Cai, X.; Rosegrant, M. W.; Ringler, C. and Scott, C. A. 1999. *Modeling water resources management at the basin level: Review and future directions*. Colombo, Sri Lanka: IWMI. (SWIM paper 6)
7. Molden, D.; Sakthivadivel, R. and Habib, Z. 2001. *Basin-level use and productivity of water: Examples from South Asia*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 49)
8. Molden, D. J.; Sakthivadivel, R. and Keller, J. 2001; 2002. *Hydronomic zones for developing basin water conservation strategies. Visi Irigasi*. Colombo, Sri Lanka: IWMI. 22:57-105. (IWMI Research Report 56)
9. Molden, D. J.; Sakthivadivel, R.; Perry, C. J.; de Fraiture, C. and Kloezen, W. H. 1998. *Indicators for comparing performance of irrigated agricultural systems*. Colombo, Sri Lanka: IIMI. (IIMI Research Report 20)
10. Molden, D. 1997. *Accounting for water use and productivity*. Colombo, Sri Lanka: IIMI. (SWIM paper 1)
11. Molle, F. 2003. *Development trajectories of river basins: A conceptual framework*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 72)
12. IIMI; Turkey. General Directorate of Rural Services. 2000. *Irrigation in the basin context: The Gediz study*. Colombo, Sri Lanka: IWMI.

13. Ines, A. V. M.; Droogers, P.; Makin, I. W. and Das Gupta, A. 2002. *Crop growth and soil water balance modeling to explore water management options*. Colombo, Sri Lanka: IWMI. (IWMI working paper 22)
14. Keller, A.; Sakthivadivel, R. and Seckler, D. 2000. *Water scarcity and the role of storage in development*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 39)
15. Keller, A.; Keller, J. and Seckler, D. 1996. *Integrated water resource systems: Theory and policy implications*. Colombo, Sri Lanka: IIMI. (IIMI Research Report 3)
16. Kendy, E.; Molden, David J.; Steenhuis, T. S. and Liu, C. 2003. *Policies drain the North China Plain: Agricultural policy and groundwater depletion in Luancheng County, 1949-2000*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 71)
17. Kite, G. and Droogers, P. 2000. *Integrated basin modeling*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 43)
18. Lacroix, M. Kite, G. and Droogers, P. 2000. *Using datasets from the Internet for hydrological modeling: An example from the Kntnk Menderes Basin, Turkey*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 40)
19. Renault, D. and Godaliyadda, G. G. A. 1999. *Generic typology for irrigation systems operation*. Colombo, Sri Lanka: IWMI. (IIMI Research Report 29)
20. Renault, D. and Makin, I. W. 1999. *Modernizing irrigation operations: Spatially differentiated resource allocations*. Colombo, Sri Lanka: IIMI. (Research Report 35)
21. Sakthivadivel, R; Thiruvengadachari, S. and Amarasinghe, U. A. 1999. *Modernization using the structured system design of the Bhadra Reservoir Project, India: An intervention analysis*. Colombo, Sri Lanka: IWMI. (IWMI Research Report 33)
22. Sakthivadivel, R.; Thiruvengadachari, S.; Amarasinghe, U.; Bastiaanssen, W. G. M. and Molden, D. 1999. *Performance evaluation of the Bhakra Irrigation System, India, using remote sensing and GIS techniques*. Colombo, Sri Lanka: IWMI. (IIMI Research Report 28)
23. Sakthivadivel, R.; Amarasinghe, U. A. and Thiruvengadachari, S. 2001. *Using remote sensing techniques to evaluate lining efficacy of watercourses*. Colombo, Sri Lanka: IWMI. v, 29p. (IWMI Research Report 46)
24. Seckler, D. 1996. *The new era of water resources management: From “dry” to “wet” water savings*. Colombo, Sri Lanka: IIMI. (IIMI Research Report 1)
25. Thiruvengadachari, S. and Sakthivadivel, R. 1997. *Satellite remote sensing for assessment of irrigation system performance: A case study in India*. Colombo, Sri Lanka: IIMI. (IIMI Research Report 9)
26. IWMI-India Strategy.
27. 2000-2005 Strategic Plan.

Field Visit Itinerary for CCER Review

Sunday January 16, 05	
AM (straight from airport upon arrival)	Visit to Musi River wastewater irrigated area.
PM (completed by 3 p.m.)	Visit to Osman Sagar Reservoir

Monday January 17, 05	
AM	Meeting with Chris Scott (Regional Director), Trent Biggs (Post Doc), Anju Gaur (Researcher)
	Presentation on past and continuing work.(TB: Krishna river basin water balance CS: Overview of activities in India.)
PM	Meeting with partner/s: Jawaharlal Nehru Technological University; AP Principal Irrigation Secretary, CVSK Sarma (to be confirmed)

Tuesday, January 18, 05	
AM	Meeting with ICRISAT watershed group.
PM	Site visit to Maheshwaram on watershed and groundwater development (with NGO partner, IRDAS).
	Teleconference with AP Principal Irrigation Secretary (Water Management), S.P. Tucker

Part 2: IWMI Management Response to the CCER Report of IWMI Theme 1

First, we would like to thank the reviewers for their carefully considered report and for the breadth of interest that they took in trying to understand Theme 1 and its place in IWMI's research program and future vision. This has already been helpful in the process of re-orienting the thematic structure at IWMI, one which began a couple of months before the review team visited Sri Lanka and India. Their constructive and friendly engagement was much appreciated.

The big picture

The review moved well beyond the strict bounds of Theme 1 in order to understand its fit and integration with, not only IWMI's research, but that of the associated programs, the Comprehensive Assessment of Water Management in Agriculture (CA) and the Challenge Program on Water and Food. It dwelt particularly on the links and synergies between Theme 1 and Theme 2 (Land, Water and Livelihoods), and to a lesser degree on those with theme 4, regarding environment-water issues at basin scale.

Rapid acceptance

Some of the key points made by the review have already been internalized in the new thematic structure and, more specifically, in the focus of Theme 1. Most importantly, the sustainability of water resources use has become one of the three sub-themes, providing balance to the more established focus on water productivity and its implications at basin scale. The water productivity focus remains but is shared more explicitly with Theme 2 (at field, farm and system scale) and concentrates on trying to understand how net basin-scale water productivity can be improved in a variety of contrasting settings. The place of institutional, economic, social and policy aspects of basin level water management has consequently been reinforced as the third sub-theme, recognizing the explicit and fundamental importance of integrating technical, institutional and economic and social factors in basin scale water management, especially in agriculture, which remains the major source of employment and livelihood in IWMI's client countries.

Despite this realignment of focus, it is important to note that key concerns regarding water accounting, use of models, GIS and remote sensing, better hydrology, policies for allocation and reallocation remain as key detail components of these three sub-themes. The review recommends broadening the focus at basin scale beyond strictly agricultural water management, both as a champion and key interlocutor for the CGIAR as a whole, but without entering into the detail of urban and rural water supply, sanitation and so on. This is logical and welcome, but will require discipline to maintain the predominantly agricultural and, to a lesser extent, environmental perspectives. The review's insistence that all aspects of irrigation remain an important focus of Theme 1 activity is highly logical given the dominance of irrigation in consuming diverted water resources.

A number of other key findings are welcome and have been embraced in the revision of the themes at IWMI:

1. The need for contextual research. The CA will provide synthesis and detail for a whole raft of future research priorities at IWMI. However, in parallel with the conclusion of the CA on 2006, IWMI needs to provide internally for continued contextual research as part of its strategic process in setting and continually refining its research agenda.
2. That meaningful and active partnerships form the basis of IWMI's modus operandum, and that field work is more and more to be undertaken by local partners with detailed knowledge and operational ability on the ground. However, it will be important to generate and maintain a good balance of intellectual ownership, input and credit in such partnerships.
3. That IWMI's main strength lies in cross-disciplinary research and, therefore, more attention is required to achieving coherence across themes and regions. The review noted the large number of projects and the associated overheads in managing them and offered sound advice on how to consolidate and in the longer term re-orientate to a more programmatic approach. The importance of understanding where IWMI has both the capacity and the potential to make an impact is well stated, and IWMI needs to significantly improve its collective ability to prioritize its focus and back it up with sufficiently detailed and rigorous research.
4. That groundwater and surface water be integrated in Theme 1, based on the significant and increasingly more evident interaction between these two phases of the hydrologic cycle. This has already been set in train since 2004, but it is good to have confirmation that this is a sensible change in approach.
5. The Knowledge Centre is a vital part of all thematic research and especially important in packaging and disseminating the outputs of Theme 1 and its sister themes. The review recommends expanding the audience to include the Latin Americas and Francophone Africa, but it will be important to screen the relevance of outputs derived essentially "elsewhere". Francophone Africa constitutes on the order of 33-40 percent of Africa, so IWMI can make a broader impact if more products are translated into French, including the "Africa Update".
6. Better integration of global water research with regional and national investigation. The recommended focus is on the impacts of global climate change, especially in wet areas, and on the impact of global food trade and the concept of virtual water. More broadly, they recommend the investigation of globalization on regional and national agricultural water management and food production. The formalization of the Global Research Division at IWMI headquarters in part reflects the same understanding and a formal effort to effect such an integration with Theme 1's basin scale focus, bringing both macro-economic and resource management perspectives together.

Further consideration required

There are other conclusions that have not yet been so rapidly internalized in the revision of IWMI's themes and project portfolio.

The most obvious mismatch is the reviewers' position that salinity (both at basin and field scale, and in irrigated and dryland areas) is under-represented in IWMI's portfolio. In the past, it has been a significant part of IWMI's agenda, particularly in Pakistan and India, but has recently taken a back-seat as IWMI has looked more broadly at closing basins in regions where salinity is not such a pressing issue. Globally, salinity remains a major threat to the sustainability of agriculture and needs a consequently higher profile. The natural home for such research lies across Themes 1 and 2.

The review points out, very fairly, that bad experience in managing water at basin scales is nevertheless instructive. This implies that IWMI should not shy away from delving into anything but the apocryphal "win-win" situations, and encourages IWMI to assert its independent position and to "tell it as it is" with good scientific backing on potentially contentious issues.

The general focus of the reviewers has been on water management and closing or closed basins, reflecting each member's experience in their own countries. As a result, they have perhaps not spent enough time considering the importance of and research agenda for well-advised water resources development for agriculture in Africa. IWMI now has an effectively split agenda between a) the case for development in sub-Saharan Africa and b) the need for reform and integrated water resources management in Asia and the newly industrializing countries. This is, in fact, a major issue for IWMI, considering that donors are by and large "tired" of research in Africa and would prefer to see 'action' on the ground. Some, therefore, tend to see IWMI more as a development consultant than a tactical and strategic player in that process, but others see us in a more strategic light, bringing research and experience from elsewhere, notably Asia: a good example is the Agricultural Water Investment program with WB, AFDB, IFAD, FAO and Nepad.

Research is no doubt necessary at all scales, but much has been done and tried before, with frustratingly little impact for many donors and national governments. IWMI would have benefited from further guidance and ideas on this subject, which is pertinent to the current broader re-focusing of the CGIAR's African mandate. However, this challenge is not unique to Theme 1 and concerns all research activities in IWMI. Practical solutions to resolving the tension between action and research and IWMI's contribution to both in SSA should be a high priority on the developing strategic agenda.

The review notes that *wadi* or ephemeral river basins are also important in many of IWMI's client countries but do not receive very significant attention. In response, we could say that this partly reflects the partnerships established but also the scale of impact on large numbers of poor, who remain our main constituency. However, IWMI will review this in some detail in the coming year and incorporate ephemeral and low flow rivers more into its research portfolio if it seems to be under-played. The associated contention that IWMI balance productivity perspectives with access to water and equity is well taken, particularly the emphasis placed on understanding the impact of farmer's risk assessment and cost/benefit on the use of intermediate solutions between rainfed agriculture and technical irrigation. This will be considered in more detail in the work program in the future.

The review implies slightly more criticism in noting that IWMI has not done enough to unpack the dynamics and historical background to the pressures and solutions in water management in closing basins. In response, we would say that the work in the Krishna and Olifants basins is particularly directed to this and provides a practical and on-the-ground complement to the nine river basin

trajectory studies being undertaken by François Molle and his colleagues as part of the CA. The CA is very much a part of IWMI and shares much intellectual territory with all the Themes, but notably with Theme 1. We think it is worth noting this close relationship, in case readers may understand the CA and IWMI mainstream to be independent and unlinked efforts.

IWMI will have to find a balance between the recommendations to reduce the size and scale of basin level investigations (to sub-basin scale, with 30,000 km² recommended as a manageable size) and other recommendations to upgrade trans-boundary and inter-basin transfer issues. A similar and inherent contradiction lies in targeting more clear-cut messages on basin level management and the “individuality” of most basins in terms of their climatic, topographic, scale, demographic and economic characteristics. Effort will be required to differentiate effectively between the generic and the specific and this presents a good challenge to Theme 1 researchers in the future. Similarly, the logic of reducing basin scale reinforces the case for more cross-basin comparison, but runs the risk of superficial investigation given the resources (staff and cash) available to IWMI.

The review has had very little to say in detail on Theme 1’s past scientific output, except to comment that it is large, influential and of recognizable and acceptable quality. This is gratifying but less than satisfying.

Additional Comments

IWMI and CGIAR Priorities: The reviewers note that IWMI has a key niche between the agriculture perspective of the CGIAR as a whole, and the NRM and water realities of the landscape at large. The proposed CGIAR System Priorities now include a specific priority area on the sustainable management of water, land and forest resources. This priority involves several focal areas closely linked to IWMI’s research agenda, including one on improving water productivity from farm to basin scales. This offers an important opportunity for IWMI to raise its profile, not so much in terms of public visibility but in what it can offer the rest of the system.

Outcome Focused Research: The review, in commending the nascent Knowledge Centre at IWMI, suggests that it could further engage clients and collaborating countries by moving more into the “how to” stage, following up on the diagnostic and recommendations approach. This idea is also a fundamental design (but not necessarily action) philosophy in the Challenge Program on Water and Food.

As part of IWMI’s new Strategic Plan 2004-2008 and Knowledge Center Initiative, IWMI has defined three key knowledge roles that complement and enhance IWMI’s primary role of research, or knowledge generation, including knowledge sharing, knowledge brokerage and knowledge application. The reviewers refer here primarily to the latter role of knowledge application and suggest that:

“The outcome [of IWMI’s research] should be developed in partnership with the potential ‘clients’ of the research, that is local partners, who are living with the problem and have a strong interest in achieving the outcome. In order to have an impact, those who can make an impact through action ‘on the ground’ must be involved from the conception of the program.” (p. 24, CCER report)

While IWMI is not well placed to put the knowledge it generates directly into the hands of all potential users, IWMI, through its Knowledge Center and Knowledge Sharing Initiatives, is

concentrating on involving appropriate development partners (NARES, local NGOs, INGOs) in the planning, implementation and evaluation of projects. These partners in turn will then be better placed to take IWMI's research findings and recommendations forward and facilitate greater 'on the ground' impact.

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