CGIAR Challenge Program on
WATER & FOOD

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CONTENTS

List of Acronyms and Abbreviations

AMA	Accra Metropolitan Assembly
ARC	Agricultural Research Council
AREO	Agricultural Research and Education Organization, Iran
ARI	Advanced Research Institute
BC	Basin Coordinator
BFP	Basin Focal Projects
CA	Comprehensive Assessment on Water Management in Agriculture
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical, Colombia
CONDESAN	Consortium for Sustainable Development of the Andean Eco-region
CP	Challenge Program
CPWF	CGIAR Challenge Program on Water and Food
CSC	Consortium Steering Committee
CSIRO	Commonwealth Scientific and Industrial Research
CURE	Consortium for Unfavorable Rice Environments
CIMMYT	International Maize and Wheat improvement Center
DFID	Department for International Development
DSSAT	Decision Support System for Agrotechnology Transfer
EMBRAPA	Brazilian Agricultural Research Corporation
EOI	Expression of Interest
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
HRU	Hydrological Response Units
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops research institute for the Semi Arid Tropics
IDIS	International Data Information System
IFPRI	International Food Policy Research Institute
IFWF	International Forum on Water and Food
IGB	Indo-Gangetic Basin
IPR	Intellectual Property Rights
IRBO	International River Basin Organization
IRD	Institut de Recherche pour le Developpment
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
JVA	Joint Venture Agreement
LUS	Land Use System
MOFA	Ministry of Food and Agriculture
MOU	Memorandum of Understanding
MTP	Medium Term Plan
MRC	Mekong River Commission
MUS	Multiple-use Water Systems
NARES	National Agricultural Research and Extension Systems
NEPAD	New Partnership for Africa's Development
NGO	Non Governmental Organization
NRLP	National River Linking Project
NRM	Natural Resource Management
NWRC	National Water Research Center

PDR	People's Democratic Republic
PIPA	Participatory impact Pathways Analysis
SCALES	Sustaining Inclusive Actions that Links Across Economic and Ecological Scales in Upper Watersheds
SIWI	Stockholm International Water Institute
STAR	System of Temperate and Tropical Aerobic Rice
TL	Theme Leader
UCDavis	University of California, Davis
UNEP	United Nations Environment Program
VRSAP	Vietnam River System and Plains
WRI	World Resources Institute
WTO	World Trade Organization
YRCC	Yellow River Conservancy Commission

1. Executive Summary

Background

The CGIAR Challenge Program on Water and Food (CPWF) is a multi-institutional research for development program that seeks to create and disseminate international public goods to improve the productivity of water in river basins in ways that are pro-poor, gender equitable and environmentally sustainable. In doing so, CPWF contributes to efforts by the global community to ensure that global diversions of water to agriculture are maintained at the level of the year 2000.

The specific objectives of the Program are to increase food production using less water, to improve livelihoods and nutrition of the rural and peri-urban poor, to decrease water pollution from agriculture, to maintain water-related ecosystems services and to reduce water-related diseases. To address these objectives, the program is structured into five thematic areas: crop water productivity improvement; water and people in catchments; aquatic ecosystems and fisheries; integrated basin water management; and the global and national water and food system. Research is conducted in nine benchmark river basins, including the Andean system, Indus-Ganges, Karkheh, Limpopo, Mekong, Nile, Sao Francisco, Volta and the Yellow.

Research in the Challenge Program is implemented through one of four focused research initiatives. First call projects, selected through a competitive process, make up the greater part of the present CPWF research portfolio. Basin focal projects add value to individual research project outputs by identifying in specific benchmark basins opportunities for water-related interventions to achieve CPWF and partner development goals. Small grants for impact serve to remind Program researchers of how their research should have practical outcomes for communities on the ground. Synthesis research is essential to drawing together a large body of disparate and diverse information into a comprehensive whole.

Research Accomplishments

The past year has seen a number of valuable technical achievements emerge from Challenge Program research. In general, these include but are not limited to; increasing water productivity in different production environments, developing mechanisms to facilitate multi-stakeholder dialogue and negotiation, valuing water to produce ecosystem services, and understanding water-food-poverty links and their policy context.

Theme 1 seeks to improve crop water productivity and has made significant progress in the areas of plant breeding and evaluation of water-efficient and stress tolerant crops; water saving farm practices and need-based water supply; and improving relevant policies and institutions. By linking farmer participatory trials of improved varieties with improved soil and agronomic management practices, researchers make use of the synergy between variety and management.. A range of soil management and mulching practices for increasing in-field capture and use of rainfall and reducing erosion have also been investigated in rain fed areas of several basins.

Water and people in catchments is the focus of Theme 2, where researchers have generated information identifying where different pro-poor technologies for improving water management are most likely to achieve impact. A bio-economic simulation model has also been developed in order to improve dissemination of a given technology, by increasing awareness of both its benefits and constraints. Economic 'game theory' is at the heart of the theme's investigations of social learning interventions, designed to build collective capacity and incentives for technology adoption. Success has also come in the form of improving stakeholder's capacity to engage with formal institutions, thanks to development of a model that allows users to quantify and value the economic, social and environmental impacts of land use changes at the watershed scale.

Theme 3 studies fisheries and aquatic ecosystems. Through applied research on the effectiveness of using adaptive learning approaches as an integral part of management processes, theme researchers contributed to developing the capacity of communities, local and national institutions to manage aquatic ecosystems in a sustainable and equitable manner.

Progress in the area of trade-off analysis has led to the development and testing of a model used to depict the consequences of different water management regimes on aquatic biodiversity, a tool that is ready for use in decision support at a district level. Theme 3 researchers have also contributed to the development of tools that enable rapid estimation of seasonal water requirements needed to sustain specific aquatic ecosystems, fish communities and fisheries.

Theme 4's focus is on integrated basin water management systems. In the past year this theme has developed, tested, and disseminated a number of innovative technologies and management strategies designed to increase the productivity of land and water resources. Tests on the utilization of a livestock water productivity framework; insights into the constraints and opportunities of wastewater irrigation and optimization of the design and operation of small reservoirs are among the advances made by researchers, leading to better basin planning and greater agricultural outputs and incomes for basin communities. A multi-agent simulation model that gives insight into the complexity of water uses and users contributed to effective policy making and improved institutional arrangements, as did a multi-disciplinary groundwater capacity building program.

Theme 5 is concerned with shaping the international, national and regional policies and institutions that influence water and food. Through organizing multi-disciplinary and organizational research teams to debate the management of upland watershed development and flood risks, among other issues, researchers learned lessons about enhancing participatory water governance at the basin scale. Research into large-scale water transfer schemes has yielded a number of published reports and papers that contributed to an assessment of a baseline scenario for Indian water and food futures to 2050.

Basin Focal Projects (BFPs) have made a number of advances in the areas of poverty analysis, assessment of water availability, water productivity, institutional analysis, intervention analysis and knowledge management. Improvements to the Water Poverty Index and water-use accounting methods as well as basin water productivity maps are among the outputs developed by BFP research teams. The BFP Impact Assessment project has supported other CPWF projects to explore the potential for scaling up and out of research results through development of a methodology called Participatory Impact Pathways Analysis (PIPA).

Synthesis research came to the fore of CPWF activities in 2006. It yielded a number of synthesis documents and was developed further through the CPWF International Forum on Water and Food (IFWF), held in Vientiane, Lao PDR. The forum brought together 245 agricultural researchers, development professionals and policy experts to debate innovative water and food technologies, management strategies, and institutional arrangements and yielded a number of papers, session reports and position papers, including the "Vientiane Statement" by researchers, development specialists and policy makers.

Small grants for impact have researched the development of locally-tailored technical and managerial practices that increase food security. Lessons learned from a number of small grants projects serve to remind researchers of the relationship between technology and the capacity of farmers to implement it.

Progress on other CPWF activities

Capacity building in 2006 focused on establishing a new portfolio of capacity building tools including interdisciplinary research cohorts, short-term field-based training courses, internships and advanced training opportunities. CPWF capacity building initiatives assist nearly 200 advanced degree students in capacity building in water resource management.

The Integrated Data and Information System Project (IDIS) is serving the water and food research community by improving access to data on water, agricultural and environmental issues. The IDIS team worked to compile and distribute temporal and spatial data for the CPWF benchmark basins along with a spatial analysis for the Basin Focal Projects. Researchers have

supported IDIS database management activities for eight additional CPWF projects whilst developing protocols for transferring scientific data to the IDIS platform.

Communications initiatives led to the creation of a number of virtual, print and video materials. The Living Labs DVD series was created in collaboration with Challenge Program investigators and Program partners in eight river basins to highlight the CPWF and its research in those regions. A wide range of print and web-based materials were also produced, including 10 research highlights, new brochures, and a regular newsletter, among others., Communication materials were actively and widely distributed throughout the water and food community via a number of international events.

Governance and Management

Signatories to the Joint Venture Agreement (JVA), under which CPWF operates, make up the Consortium Steering Committee (CSC). The committee is an autonomous policy and decision making body of the CPWF and meets face to face once a year and otherwise through virtual means. The Challenge Program Management Team comprises six people, four of them part-time, including two 'external' members. Under the JVA, the five member CGIAR centers are tasked with management of the project portfolio and work with theme leaders and basin coordinators in ensuring quality control of projects under their remit. All operations of the CPWF are managed, guided and supported from the secretariat based in Sri Lanka, where offices are provided by IWMI.

During the last quarter of 2006, CPWF was advised to update its procurement guidelines for competitive processes, following an independent external audit, commissioned by the Director of the CGIAR. A number of controls were recommended and adopted that will strengthen processes not just for the CPWF, but for all Challenge Programs and the CGIAR as a whole.

More than 200 different institutions participate officially in CPWF projects, providing expertise alongside the project lead institutions. The 2007 – 2009 Medium Term Plan provides more information about partnerships that exist across the project portfolio and within the river basins. The CPWF partnership with the Comprehensive Assessment of Water Management in Agriculture (CA) continued to be of particular importance. The CA and CPWF co-organized several sessions for Stockholm World Water Week 2006, and finalized the CA-CPWF summary of priorities and scenario predictions of CPWF basins.

Finance

There has been progress in obtaining and maintaining donor commitment. The CPWF has sufficient cash to meet the ongoing financial commitments of the program.

2. Background

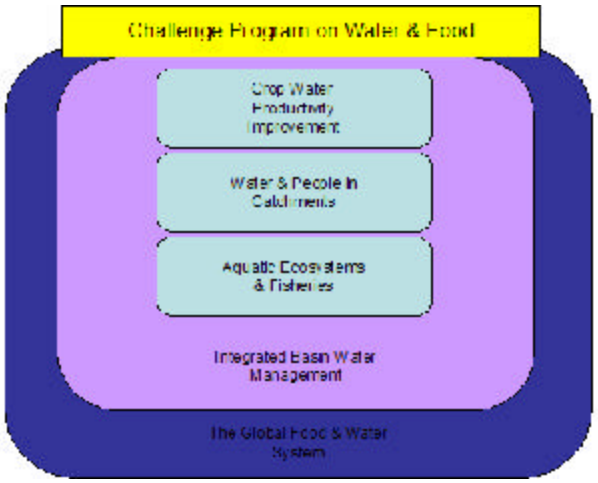
2.1 Program objectives and structure

The Challenge Program on Water and Food (CPWF) seeks to contribute to efforts by the global community to ensure that global diversions of water to agriculture are maintained at the level of the year 2000. By increasing food production the Program will help to achieve internationally adopted targets for decreasing malnourishment and rural poverty by the year 2015, particularly in rural and peri-urban areas in river basins with low average incomes and high physical, economic, or environmental water scarcity or water stress. The Program has a specific focus on low income groups within these areas.

The objectives of the CPWF are therefore, to increase food production using less water, to improve livelihoods and nutrition of the rural and peri-urban poor. However, these objectives must

be achieved while decreasing water pollution from agriculture, maintaining water-related ecosystems services and reducing water related diseases[1].

To address these objectives, the program is structured into five thematic areas at different scales. These are represented as follows:



Five senior scientists, each based in one of five CPWF consortium member CGIAR centers[2], lead the thematic areas. The research is undertaken in nine river basins that act as laboratories for the research. Representatives of National Agricultural Research and Extension Systems (NARES), a regional consortium and an international river basin organization[3] oversee the research activities in each basin. This approach ensures that regional priorities are addressed, that stakeholders are actively involved in the program, and that it has direct and measurable impacts on the quality of life in poor communities. The nine benchmark basins are the Mekong, Yellow River, Indus-Ganges, Karkheh, Nile, Limpopo, Volta, Sao Francisco, and the Andean System of Basins.

2.2 Research strategy and priorities

Full details of the CPWF research strategy are available in the 2005 publication, "CGIAR Challenge Program on Water and Food: Research Strategy 2005 – 2008" available on the CPWF web page. This document explains CPWF's mandate, the research process, research emphases, outputs and outcomes generated, and the overarching approach of five thematic areas and nine river basins which form the core of the CPWF research strategy.

Briefly, our strategy is the formation of a community of practice made up of multi-disciplinary teams of researchers addressing issues of water productivity. At the core of this community are project leaders and their teams, contracted by the CPWF through either competitive grants or commissioned research. The CPWF adds value to research results through synthesis research. This is the process of producing new insights by integrating findings from a broad range of project work (from CPWF and elsewhere). Its main purpose, therefore, is to capture new knowledge coming out of CPWF projects, and other programs and analyze them to give insights into opportunities for complimentarity, synergies and extrapolation in and across CPWF projects, basins and beyond. Synthesis research is undertaken primarily by the leaders of the five thematic

[1] See the CPWF Program Level objective tree in the Medium Term Plan www.waterandfood.org
[2] CIAT, WorldFish Centre, IFPRI, IWMI, IRRI
[3] ARC, CONDESAN, CSIR, EMBRAPA, AREO, ICAR, MRC, NWRC, YRCC

areas illustrated in Section 2.1 and is fundamental to producing added value in the CPWF and to ensuring that the cross-basin and cross-theme potential of our work on water-food-environment is fully exploited.

Basin Focal Projects (BFPs) are innovative additions to the research strategy. The challenge for the BFPs is to present a coherent picture of whole-basin systems that recognizes the large differences in hydrological conditions (and consequent livelihood systems) within and between basins. The work of the BFP teams is therefore to show the link between poverty, agricultural productivity, and water while taking into account other uses of water. The intention is to provide robust conceptual frameworks that enable scientists to analyze these links in other river basins at various scales of resolution, depending on data availability. The results will be useful for the CPWF and governments within the river basins to identify strategic opportunities for poverty alleviation through improvements in agricultural water use. Bi-lateral and multi-lateral donors who wish to invest in complementary research for development or in development projects will also benefit from research findings. An important element of these projects is to develop a scientific framework for evaluation and outreach (scaling up) of interventions (as developed in projects). The initial four BFPs were implemented in the Mekong, Karkheh, Volta, and Sao Francisco basins. BFPs for the remaining five basins, plus the Niger (funded by France) will be implemented in mid 2007.

A second addition to the strategy is the Small Grants for Impact initiative. A set of 14 competitively selected projects commenced in January 2006, with an aim to identify and harness novel, high-impact innovations in water productivity with potential to achieve significant developmental impact, thereby bridging the gap between research and development, and emphasizing impact and innovation. The initiative serves as an example and reminder for Program researchers of how their research should have practical outcomes for communities on the ground. The projects reach completion in mid 2007, after which information from the projects will be compiled through a 'lessons learned' workshop.

3. Research accomplishments

3.1 Overview

In all, 52 projects comprise the CPWF research portfolio: 33 first call projects, five basin focal projects (including a BFP coordination project), and 14 small grants projects. This portfolio operates concurrently with other research activities, including synthesis and impact assessment, both of which gained momentum in 2006. First call projects started between mid 2004 and late 2005; the others in late 2005 or early 2006.

In 2006, a second call for concept notes was advertised. Working from identified gaps in previous CPWF research, as outlined by theme leaders and basin coordinators and from summaries specially contracted by CPWF from the Comprehensive Assessment on Water Management in Agriculture (CA), theme leaders and the Challenge Program management team in consultation with the CPWF external Expert Panel on Scientific Quality provided a focused set of priorities to submit to the Consortium Steering Committee (CSC). The CSC selected six priorities and allocated a minimum of USD 4 million to the call. A total of 89 concept notes were submitted, 52 eligible ones assessed and 27 selected in September 2006 by an independent external review panel. Successful submissions were invited to develop full proposals. The proposal selection process was interrupted in October 2006 (see section 5.4.1 for details) but resumed in June 2007.

At the same time, the competitive call for an additional six Basin Focal Projects, originally published in March 2006, was cancelled when about to be completed (see section 5.4.1 for details). A new call for EOI was issued in March 2007.

In the sections that follow, Program technical achievements and outputs are described according to theme or research initiative. Achievements are presented in a way that shows progress along the impact pathways as described in the 2007 – 2009 Medium Term Plan.

3.2 Technical Outputs

3.2.1 Theme 1: Crop water productivity improvement

This theme strives to improve crop water productivity through research in crop genetic improvements for stress tolerance, crop and agroecosystem management, landscape management, innovative institutions and supporting policies.

Plant breeding and evaluation for water-efficient and stress-tolerant crops
Significant progress has been made by project 7[4] in the development and evaluation of improved varieties for a range of environments. This includes salinity and drought tolerance in non-rice and rice crops, and the commencement of its incorporation into locally preferred and adapted high yielding rice varieties for millions of hectares of sodic and/or salt affected areas, especially in the eastern Gangetic plains. There is a synergy between variety and management, and the improved varieties are being tested in farmer participatory trials along with improved soil and agronomic management. In project 2[5], participatory varietal evaluation and plant breeding have also helped to identify superior germplasm of barley, wheat and legumes (chickpea, faba beans, lentil) for the highly topographically variable Eritrean highlands in the Nile basin. Superior lines of cowpea, sorghum and cassava with increased drought tolerance have also been developed by researchers in project 6[6], ready for on-farm testing commencing in 2007 in northern Ghana (Volta basin). Project 16[7] investigators have developed three aerobic rice varieties capable of producing 4 – 6 t/ha of grain while using 30 – 50% less water than traditional lowland rice; these have been released in the Yellow River basin, while development of varieties for the Indo-Gangetic and Mekong basins is at earlier stages.

Water saving farm practices and need-based water supply
A range of soil management and mulching practices for increasing in-field capture and use of rainfall and reducing erosion are under investigation in the dry to wet rainfed areas of several basins. Results vary depending on climate and other site specific factors, hence the importance of the development, validation and application of models to identify extrapolation domains. This work is underway and minimum data sets for the models have been compiled for several applications. A different approach is used by project 6 researchers in northern Ghana. Numerous on farm trials have shown that sorghum transplanting gives an average yield and rainfall water productivity increase of 50% through advancing maturity time and avoiding terminal drought stress. In the rainfed area of the Karkheh basin, supplementary irrigation has given substantial yield increases of both wheat and barley (project 8[8]). In the coastal salt affected areas of Bangladesh, research is showing that it is possible to take advantage of the pre-monsoon rains. At the other end of the season, during the long, hot dry season when the river water becomes too saline for irrigation, research is showing the opportunity for growing a post wet season rice crop by a combination of earlier planting and sourcing freshwater from the groundwater or river water stored within the polders before it becomes too saline. CPWF project 16 has shown that aerobic rice can be grown with only 2 – 3 supplementary irrigations in the target areas of the Yellow River

[4] Project 7: Development of Technologies to Harness the Productivity Potential of Salt-Affected Areas of the Indus-Ganges, Mekong and Nile River Basins
[5] Project 2: Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea
[6] Project 6: Empowering Farming Communities in Northern Ghana with Strategic Innovations and Productive Resources in Dryland Farming
[7] Project 16: Developing a System of Temperate and Tropical Aerobic Rice (STAR) in Asia
[8] Project 8: Improving On-farm Agricultural Water Productivity in the Karkheh River Basin

and the Philippines (wet season) and initial aerobic rice production guidelines have been drafted for these regions.

Policies and institutions
Surveys and pilot trials have been undertaken or are in progress to identify and evaluate opportunities for increasing farmer access to micro-credit for inputs, availability of quality seed of improved varieties, and availability of seed, fertilizer and other inputs in small, affordable packages. An effective network has been established for the exchange and knowledge of the performance of genetic material in salt-affected environments within the Consortium for Unfavourable Rice Environments (CURE). Results from the work on aerobic rice have begun to inform the research priority setting process and training activities in several countries.

3.2.2 Theme 2: Water and people in catchments

Using both technological and institutional interventions, this theme aims to develop water management strategies that support more equitable and sustainable livelihoods within catchments.

Understanding water and poverty in upper catchments
A solid understanding of catchment hydrology, especially land/water interactions, is imperative if any technical or institutional intervention is to be designed and implemented in a way that successfully addresses livelihood issues. Theme 2 projects are contributing to the design of appropriate technologies by generating information on the role of water in the livelihoods of the poor. In the Limpopo basin, CPWF project 17[9] seeks ways to increase water availability for the poor. Project researchers found that use of drip kits can reduce the need for irrigation water by up to 50%. However, poor farmers with no water resources of their own cannot benefit from the drip kits unless access to water is improved. Based on this finding, a protocol for sustainable drip kit distribution, requiring a detailed analysis of the existing water resources to assess availability and potential conflicts prior to distribution of drip kits, has been developed and adopted by a number of NGOs in Zimbabwe.

The introduction of water management systems designed to support multiple uses (MUS) is another way Theme 2 researchers seek to benefit the poor. Project 28[10] has, through research on MUS systems in 10 countries, created a generic framework for designing, implementing and up-scaling MUS systems that has been adopted for use in five basins: Andean system, Indus-Ganges, Limpopo, Mekong, and Nile. Successful advocacy work on the part of project researchers and participants has led to wide-spread commitment to MUS by many water professionals and development practitioners. For instance, MUS was accepted as a stand-alone topic session at the World Water Forum in Mexico, and received full endorsement by the top management of the Department of Water Affairs and Forestry in South Africa.

Economically valid technologies
Once technologies exist, the next challenge is to ensure their adoption. In some cases, such as soil and water conservation practices, adoption requires investment in the short run that only pays off over time. In addition, not all of the benefits from adoption accrue to the farmers; in some cases, downstream people may also benefit although these benefits may not be taken into consideration by decision makers. Effective dissemination strategies need to take into consideration all of the benefits and constraints associated with a technology to ensure that they are attractive at both the individual and aggregate scale. Project 22[11] has developed a bio-

[9] Project 17: The Challenge of Integrated Water Resource Management for Improved Rural Livelihoods: Managing Risk, Mitigating Drought and Improving Water Productivity in the Water-Scarce Limpopo Basin
[10] Project 28: Models for Implementing Multiple-Use Water Supply Systems for Enhanced Land and Water Productivity, Rural Livelihoods and Gender Equity
[11] Project 22: Payment for Environmental Services as a Mechanism for Promoting Rural Development in the Upper Watersheds of the Tropics

economic simulation model that estimates the on and off farm impacts of the adoption of farming practices. The model, implemented in the Andes with pilot-scale success, has been used to determine financial compensation to farmers for reducing water use or improving water quality by reducing siltation and contamination. The approach is currently being validated in the Limpopo and Nile basins.

Fostering and supporting collective action

While it is important to maintain a focus on individual incentives for technology adoption, some technologies such as water management systems (potable, water harvesting, irrigation, spring protection) require collective investment. In other cases, individual level technologies such as soil and water conservation practices will only have catchment scale impacts if they are widely adopted. These cases require an understanding of both individual and collective incentives for technology adoptions. Project 20[12] is testing social learning interventions designed to build this collective capacity in the Andean system and Nile basins. Using methods drawn from economic 'game theory', project researchers simulate realistic situations in which an individual's decisions affect not only his/her payoffs, but those of other players as well. The games, when used in a watershed context, have given insight into how people cooperate in water management and in assessing the size of losses from failure to cooperate. Changing the rules of the game or composition of the player groups reveals important information about how best to foster trust between upstream and downstream water users.

The use of gaming approaches is taken one step further in the Mekong basin. Project 25[13] uses companion modeling, where agent-based models are combined with participatory role-playing games to elicit stakeholders' knowledge and perceptions of water dynamics, examine scenarios of resources sharing and stimulate dialogue in order to help resolve water-related conflicts. A companion modeling exercise in one watershed in northern Thailand led stakeholders to understand the huge difference in benefits and benefit distribution associated with different water management options. When an opportunity arose to invest in public funds in irrigation infrastructure, community members, also companion modeling participants, agreed to propose an option where the modeled outcome was highly attractive to all stakeholders.

Understanding social and hydrological systems

The work on fostering collective action around a particular technology or natural resource management (NRM) problem is often the basis for interventions designed to improve water and other NRM institutions more broadly. For example, a better understanding of the bottlenecks to achieving desired outcomes such a technology adoption or better collective management can lead to identification of appropriate institutional and biophysical entry points for interventions. The action research approaches of projects 28, 22 and 17, among others, involve analyzing problems scientifically and then looking at how those problems can be addressed within the existing social and political environment. The lessons from these experiences can lead to better decisions in specific instances as well as to changes in existing policies and institutions. In some cases, achieving these changes requires that stakeholders improve their capacity to engage with formal institutions such as government officials or environmental authorities. For example, project 22 studies the relationship between land use and hydrology in the Andes. Using the concept of Hydrological Response Units (HRU), defined as the minimum hierarchical level required to integrate hydrological dynamics and performance of production systems, researchers have been able to identify the location and magnitude of negative externalities and who is causing them. When the HRU concept is applied to a model for ex-ante evaluation of alternative land use, users can quantify and value the economic, social, and environmental impacts of land use changes at the watershed scale. This approach has resulted in a greater appreciation of the potential for conservation agriculture and agroforestry systems to reduce negative externalities.

[12] Project 20: Sustaining Inclusive Collective Action That Links across Economic and Ecological Scales in Upper Watersheds - SCALES

[13] Project 25: Companion Modeling for Resilient Water Management: Stakeholder's Perceptions of Water Dynamics and Collective Learning at the Catchment Scale

3.2.3 Theme 3: Aquatic ecosystems and fisheries

Theme 3 studies the contribution of fisheries and aquatic ecosystems to livelihoods, the value of the ecosystem services they provide, and the ways in which these values are considered in water-use decision making processes.

Frameworks for policies and institutional arrangements for managing aquatic ecosystems and fisheries
Theme 3 aims to develop capacity in NARES to manage aquatic ecosystems in a sustainable and equitable manner. In 2006, the objective was met in part through improved understanding of the institutional context of the project sites and through strengthened capacity of NARES partners to conduct research activities and institutional analysis. Partnerships have been established with local organizations to facilitate work on community management and organization. Project 35[14] conducts research on the effectiveness in three different basins of an adaptive learning approach as an integral part of the management process. Project partners are encouraged to work with stakeholders to evaluate their interventions and identify strategies for improving previous outcomes. As a result, project beneficiaries in Bangladesh have an increased awareness of the role they can play in the management of the floodplain, thereby increasing their capacity to obtain a greater proportion of floodplain benefits through engagement with other stakeholders and government agencies.

Valuation of ecosystem goods and services
Progress made by Project 10[15] in the area of trade-off analysis led to development and testing of a model of the consequences of different water management regimes on aquatic biodiversity. The BayFish trade-off model highlights the need for a clear identification of the socio-political options that drive environmental management. The outputs of another model, the Vietnam River Systems and Plains (VRSAP) model, which describes the consequences of sluice gates management on water quality and water control scenarios are integrated in BayFish. The tool is ready for use in decision support at the district level.

Improving water productivity in aquatic ecosystems
In 2006, the theme sought to develop management strategies for optimizing benefits from culture-based fisheries in reservoirs and community-based fish culture in irrigation systems and seasonal floodplains. This objective has largely been achieved in large part due to projects 35 and 10 which have contributed to the development of simple tools that enable rapid estimation of seasonal water requirements, specific to different sorts of aquatic systems, needed to sustain aquatic ecosystems, fish communities and fisheries. Both projects contribute tools for determining water requirements, while project 35 also works on in-river structures and project 10 on irrigation system design and management.

3.2.4 Theme 4: Integrated basin water management systems

Theme 4 contributes to the broader goal of reducing levels of poverty through sustainably increasing productivity of land and water resources, thereby increasing basin level agricultural output and income. Projects operating under this theme focus on increases associated with (a) tapping the potential of under-utilized land and water resources; (b) improving the technical and economic performance of existing agricultural production systems; and (c) enhancing sustainability through reduced pollution and over-use of water and land resources.

[14] Project 35: Community-based Fish Culture in Irrigation Systems and Seasonal Floodplains
[15] Project 10: Managing Water and Land Resources for Sustainable Livelihoods at the Interface between Fresh and Saline Water Environments in Vietnam and Bangladesh

Innovative technologies and management strategies developed, tested and disseminated

Data generated by project 5[16] allows for better understanding of yield response to technical change. The data adds to our knowledge of site characterization and of identification of recommendation domains in the Volta basin, specifically, areas where the prototype "Savannah Eco-farm" and "Sahelian Eco-farm" would perform well. The data will also be used to calibrate and validate the Decision Support System for Agrotechnology Transfer (DSSAT) model which will be used to generate information on spatial and temporal variability of cereal yield in the Volta basin. In this way, the project moves closer to determining the hydrological, social, environmental and economic impacts of basin wide application of profitable on-farm technologies and management strategies.

Project 37[17] carried out detailed studies in Uganda, and Ethiopia to test the utilization of the livestock water productivity framework developed by project researchers. Using this framework, farmers and extension officers have increased their awareness on five complementary strategies: (a) adopting a diversified feed source strategy that includes natural pasture, improved pasture, crop residues, or rainfed/irrigated grain or fodder; (b) managing pastures to improve feed quantity and quality per unit rainfall or irrigation water applied; (c) increasing the efficiency of feed utilization through appropriate storage to reduce wastage; (d) adopting livestock management strategies (livestock type, variety, health status, feeding habits) which increase livestock production per unit of feed and per unit of water; and (e) investing locally in livestock processing and marketing strategies that add value and increase "shelf-life". New insights generated by this project have enhanced cooperation between ministries of agriculture, livestock, environment and water in Uganda and raised awareness of the enormous livestock feed that irrigation systems produce as a by-product in Sudan. Project investigation has also lead to investment in rehabilitation of degraded grazing land and livestock water supply by NGOs in Ethiopia.

Project 38[18] continued to shed more light on constraints and opportunities of wastewater irrigation. The risk assessment studies have raised awareness of health risks and strategies to minimize health risks. Through frequent interactions of project researchers with urban planning and health department officials, insights from the project are now being integrated into the operational procedures of these departments. Farmers have increased uptake of technical strategies that reduce health risk and enhance outputs and incomes. Wastewater irrigation has also gained national recognition through the introduction of a best waste-water farmer category in Ghana. All these experiences have implications throughout developing countries where wastewater irrigation is increasingly important in urban and peri-urban economic activities.

Project 46[19] has generated a knowledge base on a wide range of issues and developed tools for optimizing basin level planning and design and operation of small reservoirs. At basin level the focus is on determining the optimal number, capacity and location of small reservoirs so as to balance the needs of water locally and in downstream locations. The utility of remote sensing based tools developed by the project for mapping location and assessing their storage capacities has been recognized by planning units of departments of water affairs and of river basin organizations. At local level, farmers in Ghana, Burkina Faso, Brazil and Zimbabwe are benefiting from new insights on how to improve agricultural outputs (fish and irrigated agriculture) from the water stored in the reservoirs, how to share the water more effectively, how to reduce water pollution, and how to reduce associated health risk.

[16] Project 5: Enhancing Rainwater and Nutrient Use Efficiency for Improved Crop Productivity, Farm Income and Rural Livelihoods in the Volta Basin

[17] Project 37: Increasing Water-Use Efficiency Food Production through Better Livestock Management – Nile River Basin

[18] Project 38: Safeguarding Public Health Concerns, Livelihoods and Productivity in Wastewater Irrigated Urban and Peri-urban Vegetable Farming in Ghana

[19] Project 46: Planning and Evaluating Ensembles of Small, Multi-purpose Reservoirs for the Improvement of Smallholder Livelihoods and Food Security: Tools and Procedures

Effective policies and institutional arrangements

Case studies produced by project 40[20] have identified collective action problems and technical issues that should be taken into consideration in water governance, as well as main areas and sources of conflicts and technical and governance options for sustainable water management. They have adapted and applied a Multi-Agent Simulation model to gain insights into the complexity of water uses and users. The simulation model and other tools have generated information needed to support good governance processes, for example, to assess the impact of technical change and informal water markets on household income and water use efficiency. In its outreach activities, the project has developed and applied an influence network mapping tool. This tool was applied in understanding influence network maps of the board members of the White Volta Basin Authority in Ghana. It improved the understanding of board members' political arenas, their influence and how they can use their influence and their networks to improve the performance of the Board and catalyze progress towards sustainable water management in the basin.

Project 42[21] through its innovative capacity building program continued to expand the knowledge base and networks required to tackle the burgeoning problem of groundwater governance in China, Nepal, India, Bangladesh and Pakistan. Through a series of case studies, project researchers have documented (a) trajectories of technological change in response to increasing demand for groundwater, falling groundwater tables, rising energy prices and increasing water pollution; and (b) the evolution of the groundwater economy in response to policy and legal reform, privatization, groundwater markets, energy price increase and adoption of water saving technologies. The information generated is being disseminated as web-based training material on groundwater governance, as journal articles, technical and policy briefs and as mass media material (TV broadcast, videos and newspaper articles). The largest impact of this project is likely to come from the multi-disciplinary (natural and social scientists and the media) and regional and national approaches that the project is promoting.

Decision support tools and information

Project 36[22] carried out case studies to investigate dam planning and operational issues and how to address them. The main insights are on how benefits derived from dam reservoirs can be enhanced through better planning and operation of dams and on how benefits can be shared. The project findings were disseminated during an International Workshop organized by the project and attended by dam planning and operation specialist from USA, Germany, Netherlands, and eight Sub-Saharan African countries. The workshop papers were submitted to the International River Basin Management journal. Some of the major findings will be incorporated in the guidelines being developed by Dam Development Project of UNEP. These dissemination pathways will facilitate enhanced use of the information in the identification of opportunities for enhancing investment in more sustainable water storage.

3.2.5 Theme 5: The global and national food and water systems

The goal of Theme 5 is to support policymaking both within and outside the water sector, to enhance food security and human health, to promote the production of more food with less water, to help alleviate poverty, and to protect ecosystems. Researchers investigate the links between policies normally seen as lying outside the water sector, such as those on trade and macroeconomic issues, and policies specific to the sector, such as those on water rights, prices,

[20] Project 40: Integrating Knowledge from Computational Modeling with Multi-Stakeholder Governance: Toward More Secure Livelihoods through Improved Tools for Integrated River Basin Management
[21] Project 42: Groundwater Governance in Asia: Capacity Building through Action Research in Indo-Gangetic (IGB) and Yellow River (YRB) Basins
[22] Project 36: Improved Planning of Large Dam Operation: Using Decision Support Systems to Optimize Livelihood Benefits, Safeguard Health and Protect the Environment

and investment. They also evaluate policy-related strategies for adapting to change, mitigating its negative effects, and enhancing pro-poor agricultural growth.

In 2006, research progress was made in all four key research areas of Theme 5 along the impact pathway graphically depicted in the objective tree of the Medium Term Plan:

The Role of Globalization, Trade, Macroeconomic, and Sectoral Policies in achieving water and food security

Project 50[23] contributed to advances in this research area through organizing multi-disciplinary and organizational research teams for interaction and debate in the areas of management of upland watershed development; flood risks; institutional dimensions of global environmental change; and informed and fair water and trade futures. Issues cross-cutting these comparative studies aim to draw attention to critical principles and practices of social justice, dialogues, policies and knowledge that underpin the democratization of water governance in the Mekong basin countries.

Incentives, Investment and Financing of Agricultural Water Development and Water Supply

This key research area is studied comprehensively through a project located in India: Project 48[24]. In 2006, the project completed its first phase of assessing the social and economic costs and benefits of the NRLP, which has been designed to ease water shortages in western and southern India while mitigating the impacts of recurrent floods in the eastern parts of the Ganges basin. Project researchers published several working papers and reports on such diverse topics as: the future of irrigation; agriculture and the WTO; environmental flow requirements of rivers; demographic projections; the future of food grain production; urban population growth; water productivity and water savings; consumption patterns and changes in the structure of food demand; groundwater management; labour migration; and water harvesting and rainwater management. These papers together contributed to an assessment of a baseline scenario for Indian water and food futures out to 2050, which provides the basis for assessing the Indian NRLP, and is beginning to enter the larger debate on the NRLP nationally. There are many lessons internationally for large-scale water transfer schemes in other countries and basins.

Transboundary Water Policy and Institutions

Project 50 organized a "Mekong Region Waters Dialogue" in mid 2006, which is an example of a "multi-stakeholder platform". As a result of the Mekong Region Waters Dialogue in Vientiane, there has been greater recognition by Mekong country states and multilaterals that they must improve their level of engagement with other sectors in Mekong societies. Project 47's[25] entire program is dedicated towards investigating and sharing mechanisms that allow the poor a voice in the sharing of transboundary water resources. Participants at the African Water Laws Workshop (2005), organized by project 47, called for research and capacity building to record and understand community-based water arrangements and the interface with other legal frameworks, including the gender dynamics of how water is used for multiple purposes.

Adapting to Changes in the Global Water Cycle.
In 2006, Project 53[26] has developed conceptual frameworks and is finalizing the development of several modeling tools at different scales of analysis to support governments in South Africa and

[23] Project 50: Multi-scale Mekong Water Governance: Inter-disciplinary Research to Enhance Participatory Water Governance from Local Watershed to Regional Scales
[24] Project 48: Strategic Analysis of India's National River-Linking Project (NRLP)
[25] Project 47: Transboundary Water Governance for Agricultural and Economic Growth and Improved Livelihoods in the Limpopo and Volta Basins: Towards African Indigenous Models of Governance
[26] Project 53: Food and Water Security Under Global Change: Developing Adaptive Capacity with a Focus on Rural Africa

Ethiopia with policy analysis tools useful for adaptation to climate change. These tools are likely to have widespread applicability.

3.2.6 Basin Focal Projects

The first four Basin Focal Projects (BFPs), commissioned in late 2005 (Mekong, Volta, Sao Francisco and Karkheh[27]), are well established and producing detailed analysis on poverty, hydrologic conditions and water productivity within basins. While teams have varied the methods of analysis to accommodate variations in availability of data and expertise, there is considerable overlap enabling comparative analysis to be undertaken of certain key issues across basins.

There exist some institutional and political difficulties in the Karkheh and negotiations are under way to determine whether this BFP team can continue to work in the entire basin, or just the upper Karkheh.

Unfortunately, the competitive call for six new BFPs was cancelled in October 2006 (see information in section 5.4.1). As a consequence, the intended six new project teams could not participate in the BFP workshop held immediately before the CPWF International Forum on Water and Food in November 2006 as had been planned. However, during that meeting, existing BFPs took further the sharing of ideas, including the development of cross-basin research interests.

The BFPs have made advances in the areas of poverty analysis; assessment of water availability; water productivity; institutional analysis; intervention analysis and knowledge management. These areas correspond to six work-packages, developed during the inception of BFPs, as a useful framework from which to approach the research. Teams for the second set of BFPs are being identified and assessed against these same work-packages and will therefore benefit from the development phase of the first round of projects.

Poverty analysis: All basins have assembled the best available data on poverty and analysis is well advanced, though efforts to define the link between water and poverty are at an early stage. A major achievement in this area, led by the Institute for Research and Development (IRD), is in improving the Water Poverty Index, proposed by Sullivan et al. By using Bayesian Network analysis, which can accommodate a wide range of data types, the BFP Water Poverty Index overcomes rigidity and data combination problems of the original index[28].

Assessing Water Availability: The following lead institutions have all used innovative techniques to quantify the condition of water resources, a necessary step toward understanding the impact of water on livelihoods, Commonwealth Science and Industrial Research Organisation (CSIRO), International Water Management Institute (IWMI) and the University of California (UC) Davis. CSIRO developed a water-use accounting method for the Mekong in order to accelerate conventional hydrologic modelling[29]. The model has been applied to the Mekong, Karkheh and Limpopo basins with plans for use in the Volta and other basins. UC Davis coupled low-resolution MIKE-BASIN modelling with high-resolution MOD-HMS process based modelling for detailed flow estimation. IWMI used a spatially disaggregated water balance model, coupled with SEBALS estimation of evapotranspiration (ET) to provide detailed insight into water flux in the Karkheh.

[27] Led by CSIRO, IRD, UC Davis, and IWMI, respectively. For more information visit http://basinfocalproject.pbwiki.com/

[28] The Index in its current form is available from the BFP wiki http://basinfocalproject.pbwiki.com/upload.php

[29] The water-use accounting method is here BFP wiki http://basinfocalproject.pbwiki.com/Basin%20Projects

Water productivity: The basic concept of water productivity is defined as the benefit derived from a given volume of water consumed[30]. BFP teams from the Karkheh, Mekong and Volta have developed water productivity maps for their basins, while the Sao Francisco team extended this to include a more complex multi-crop value index map[31].

Institutional analysis: Few teams have yet progressed far with institutional analysis beyond establishing contacts with immediate stakeholder groups necessary to undertake analysis. Once BFPs have established how best to respond to the needs of stakeholders, a task for the BFP coordination project in 2007 is to identify users of the project outcomes to determine how BFP outputs can be developed into products of most use to beneficiaries.

Intervention analysis: Teams in the Sao Francisco and Karkheh are leading the way on analysis of livelihood systems. In the Karkheh, this is through detailed field surveys coupled to biophysical analysis. In the Sao Francisco, this is through Land Use Systems (LUS) analysis, and other econometric models that are able to predict farmer behaviour under dynamic operating environments. LUS is being adopted by other basin teams.

Knowledge management: Knowledge management is an increasingly important role for the BFP coordination project. In addition to a number of cross team workshops, wiki pages and web page, there are plans to make an Integrated Database Information System (IDIS) the main communication tool as it evolves from a data warehouse to platform for information exchange.

3.2.7 BFP Impact Assessment

The BFP Impact Assessment project is a sub component of the BFP coordination project. It has a cross basin perspective and complements the individual BFPs by providing information on the impact potential of the current CPWF portfolio of projects. A methodology called Participatory Impact Pathways Analysis (PIPA) was developed in 2006 and used to facilitate the construction of impact pathways for projects in the Volta, Mekong, Karkheh, IGB and Andes basins. By linking impact pathways work with network modeling, researchers focus on who they need to include in their project in order to undertake research, ensure adoption, and achieve impact. Extrapolation domain and scenario analysis was carried out for selected projects to explore the potential for scaling up and out of high potential research products. A component of PIPA - the use of problem and objective trees to clarify and communicate the logic of a project - was adopted by the CPWF Secretariat in the CPWF Medium Term Plan 2007 -2009. The Science Council said the following:

"The CPWF has introduced the use of "objective trees" at the MTP project and program level, a useful and innovative complement to the MTP logframe. In addition to providing a useful overview, the process of preparing these flow charts has clearly helped the CPWF provide the necessary focus, clarity and cohesion that now exists in the research plans at all levels."

World Fish, CIMMYT and ICRISAT have used elements of PIPA in planning processes, including formulation of their MTPs for 2008 - 2010.

A follow-up of the outcomes of the first Impact Pathways Workshop held in the Volta Basin yielded positive feedback. Inspired by the knowledge gained at the workshop, CPWF project 40 developed a methodology for "Influence Network Mapping,"[32] while the workshop helped a project 38 identify the Ministry of Food and Agriculture (MOFA) and Accra Metropolitan Assembly

[30] Water productivity measures the performance of agricultural systems with respect to the water they consume. For more information visit http://waterproductivity.pbwiki.com/

[31] More detail can be found at the BFP wiki http://basinfocalproject.pbwiki.com/

[32] see http://www.igm.uni-hohenheim.de/cms/fileadmin/documents/ProjectDocs/ResearchDocumentation/Schiffer2006_Influence_Network_Mapping.pdf

(AMA) as key stakeholders; researchers subsequently lobbied both organizations to change a crucial by-law. Project 42 attributed their success in organizing a workshop on Capacity Building Needs Consultation involving primary stakeholders to the clarification and crystallization of project outputs as derived from constructing project problem and objective trees taught to them in the workshop. On the whole, the workshop motivated projects working in the basin to meet to identify synergies and share impact pathways methodology with colleagues who had not attended the workshop.

Cost Benefit Analysis
In response to a request by the CSC at their 2006 meeting to provide a rigorous and more quantitative analysis of investment in and by the CPWF, a study has been commissioned that builds on the data collected by the impact assessment project. The project will become active in 2007 and intends to carry out cost-benefit analysis to quantify some of the high potential impacts that the CPWF is likely to achieve and to provide hard evidence that the respective progress along the impact pathways has begun.

3.2.8 Synthesis

In 2006, synthesis came to the fore of CPWF research activities. Nine basin profiles, the CPWF Baseline Report, and Synthesis 2005 report were released to the public, and an on-line platform for synthesis was established. Rounding out 2006 synthesis activities, the CPWF International Forum on Water and Food was a great success. These products are explained below and are accessible through the CPWF website.

Nine *Basin Profiles* draw together the information available in each of the benchmark basins at the start of the CPWF research period. They provide descriptions of the biophysical, socioeconomic, and institutional settings of each basin, as well as discussion of the water, food and environment related challenges and a projected research agenda[33]. The *CPWF Baseline Report* draws together these individual profiles, links them with the status of research identified in the CPWF thematic areas, describes the situation facing the Program at the commencement of implementation of CPWF research. It identifies emerging issues and draws attention to how CPWF might address these issues[34].

Synthesis 2005 reviews CPWF research activities and achievements according to theme and with an emphasis on the 33 first-call competitive grant projects. Cross-basin and cross-theme implications are highlighted along with opportunities for collaboration or dialogue across projects[35].

A major CPWF event for synthesis, the *CPWF International Forum on Water and Food (IFWF), November 2006* held in Vientiane, Laos saw 245 agricultural researchers, development professionals and policy experts gather to discuss and debate wise water management strategies, innovative technologies and effective institutional arrangements at multiple scales. Great effort went into designing and implementing an original and stimulating event. Participants commented on the extraordinary energy palpable during the week and described it as a model for future scientific conferences. An impressive range of scientific outputs, including papers, session outputs and position papers was produced. These are available on the Forum website at http://forum.waterandfood.org.

On-line synthesis: A web-based platform for synthesis attempts to capture results and ideas from CPWF projects and related water and food research on an ongoing basis, through a few direct, impact related questions posed by each theme every three months. Theme leaders have

[33] http://www.waterandfood.org/basins.html
[34] http://www.waterandfood.org/publications/synthesis.html
[35] http://www.waterandfood.org/publications/synthesis.html

engaged in a rigorous process of establishing a framework by which to develop monthly questions so that input received is of the highest value to the overall synthesis process. These questions have a direct relationship to the objective trees in the CPWF Medium Term Plan, projects 1 – 5. Please refer to http://synthesis.waterandfood.org for more details. The questions also form part of the monitoring and evaluation process, as selected projects will be required to respond to questions that relate directly to the research undertaken in their projects.

3.2.9 Small Grants for Impact

The small grants projects have thus far succeeded in aiding the development of locally-tailored technical and managerial practices that increase food security, often while reversing environmental degradation. The small grants for impact initiative has revealed important information about the processes that most effectively lead to the adoption of beneficial technological and managerial solutions, and about the opportunities for scaling-up the impact of interventions. The major lessons of the projects to date deal largely with the way that researchers and development experts can encourage widespread uptake of new technologies and practices. An example of a small research grant for impact is described in the box below.

SG 503: Enhance adoption of high potential interventions for increasing agricultural water productivity, Tanzania
Upon identifying constraints on the adoption of water saving and moisture innovations – namely, not enough land or labor (including insecure land tenure) and the farmer's feelings of not having enough education, expertise, or experience to properly implement them - interventions in the form of exchange visits and the use of innovator farmers as local leaders as educational tools as well as training in specific technologies and management practices addressed community lack of expertise and helped to overcome a lack of 'risk willingness'. Project leaders involved villagers in gathering information about commonly used innovations (such as storage ponds or tanks, wells, wetlands, tree planting, basins/borders, terraces), in analyzing those innovations, and scaling up by disseminating the information to other farmers who could use it. These lessons have wide applicability, especially in reminding researchers of the relationship between technology and capacity of farmers to implement it.

4 Progress on other CPWF activities

4.1 Capacity Building

Thanks to the efforts of a full-time capacity building officer, CPWF completed in 2006 just over a year of work on three interrelated tasks:

- describing and evaluating the capacity building ongoing in the first call research projects;
- identifying needs outside of the first call projects;
- developing partnerships and plans to extend the scope of capacity building for water and food research.

Communication materials were developed, including an investment portfolio for future capacity building initiatives. The investment portfolio outlines a selection of capacity building mechanisms under development, including interdisciplinary research cohorts hosted by North-South University Partnerships; short-term field-based training courses based on CPWF research themes; water and food internships; and advanced training opportunities offered to current CPWF projects. The portfolio was disseminated during visits to donors at the Swiss Development Corporation and the United States Department of Agriculture as well as through consultations with potential partner organizations, including the University of California Davis, Borlaug Leap Fellowship Program; and the International Foundation for Science in Stockholm.

This revised strategy was field-tested through stakeholder needs assessment workshops, involving academics, NARES researchers, and development practitioners. Needs assessment workshops were completed in the Limpopo, Volta, and Nile river basins, conducted respectively in January, April, and May of 2006. Common needs expressed across all basins included the need for applied, field based research; for training in participatory methods; and for more social science training.

A capacity building inventory report was undertaken in 2006. The report: *Capacity Building in CPWF Research Projects 2004 -2006* identified three major categories of capacity building reported by project leaders: scientific mentorship; specialized skill training; and action research methodologies. In 2006 CPWF supported at least 163 students from 24 countries. Most students are assigned to cross-thematic projects and 61 percent of them live in African countries. Across the program, the bulk of students are learning water-related fields, with a greater emphasis on the biophysical sciences than the social sciences.

4.2 Data and information management

4.2.1 IDIS – the Integrated Data and Information System project

Data and information management continues to be a major challenge for researchers and practitioners. To address this challenge, CPWF, in partnership with IWMI, invested in a data and information sharing initiative - the Integrated Data and Information System (IDIS) project. IDIS is an on-line data and information sharing platform that improves access to data and information on water, agriculture and environment issues.

IDIS is serving the water and food research community by contributing to reducing the time researchers spend in accessing and managing data. The IDIS team compiled available temporal and spatial data for the CPWF benchmark basins as inputs for the time series and spatial analysis of Basin Focal Projects. The data was distributed in the form of IDIS basin DVDs. The IDIS team also supported eight other CPWF projects to adopt good database management practices. This also served as a basis for developing protocols for transferring data from project databases into IDIS.

The system comprises of a set of databases, data quality control and loading procedures and utilities, metadata, and supporting hardware and became fully operational in July 2006. A CIAT team contributed to the enhancement of the data access sub-system; and hardware and software measures have been put in place to guard against hardware failure, computer network (cyber) attacks and illegal access or download of data that is not in public domain category. To secure intellectual property rights (IPR) on the data from on-going research projects, the data are stored with restricted access (only accessible to the project research team members for a duration of one to two years). Consequently, both public domain and restricted access data sets are stored in the databases. Data sets (104 Gigabytes) on climate, water, soil, land use, hydrology, agriculture, biodiversity and socio-economic parameters are now available. Two computer main severs (one in Colombo and the other in Pretoria) have been installed and facilitated the access of over 10,000 visitors and 3200 data downloads. The IDIS metadata is linked to GEONETWORK thereby linking our servers to a larger community of water, food and environment researchers and practitioners.

In future, information generated by researchers will be packaged for use by basin stakeholders in the form of performance indicators (for example water productivity and poverty maps) and best-bet technical and institutional intervention options for addressing water, food and environmental challenges that they face.

4.3 Communications and public awareness

4.3.1 Communications

Communications initiatives in 2006 focused on creating and implementing a communications strategy and operational plan for the CPWF. Projects have centered on marketing the program and its activities and improving information sharing and communications within the CPWF.

With an aim to target donors, development practitioners and water and food researchers both within and outside of the CPWF, significant investments were made in developing a coherent package of virtual, print and video materials, available on the website[36]. These include:

Living Laboratories, DVD series: Building on the work of two previous CPWF program videos, TVE Asia, in collaboration with partners in eight of the nine CPWF river basins produced a 30 minute documentary about the program, and a series of short films featuring projects in eight basins. The DVD series had its premiere at the International Forum on Water and Food.

Print Materials: In 2006, CPWF updated and redesigned our program, theme and basin brochures, added capacity building and IDIS brochures to the portfolio, produced 10 research highlights, two synthesis reports and other program documents. A shared brochure among the four CPs was also completed. These were widely distributed through international water and food related events.

Publication series: CPWF recently developed publications guidelines that allow for both a research report and a working paper series. By the end of 2006, several papers were ready to initiate the review process. This is additional to the many papers published by CPWF researchers through other routes.

CPWF Website: With further content development in 2006, the website has allowed CPWF to be the major hub of information about the program, with dynamic content and accessible to all visitors, regardless of bandwidth. In 2006, the website received, between 8000 – 10 000 unique* visitors each month, navigating, on average, 3 pages into the site. (* an IP address is only registered once).

Water and Food Newsletter: Distributed to the CPWF community and available on the web the newsletter continued to offer a platform for highlighting specific research projects and giving insight into the Program's activities. In the last quarter, the decision was made to end production of the print version of the newsletter and update the 'look' of the electronic edition.

A number of online tools were developed and refined in 2006 to facilitate discussion and exchange of information among CPWF members located around the globe.

Online discussion spaces: These spaces offer the management team, theme leaders and basin coordinators a place to share information on the projects as well as information about their interactions with projects.

4.3.2 Public awareness

CPWF was very active in a number of scientific meetings on water and agriculture during 2006 in which major international participation in events such as the 4th World Water Forum and Stockholm Water Week, among others, culminated in the CPWF International Forum on Water and Food. CPWF also made a special presentation at the World Bank CP Day in March 2006.

[36] http://www.waterandfood.org/publications.html

4th World Water Forum, March 2006: CPWF organized and presented a seminar entitled "Water for Food, Livelihoods and the Environment: Bridging the Gap through Partnership in Research".

Stockholm World Water Week, August 2006: In collaboration with the Comprehensive Assessment of Water in Agriculture, CPWF co-organized several sessions, including: "Turning Assessment Findings to Action: the results of the CA"; "Drought, Risk and Management for Agricultural Water Use"; "Multi-scale River Basin Governance"; "Practical Implementation of Integrated Water Resource Management in Africa" (with the European Union Water Initiative); and "Closing basins – soft or hard landing?" (with SIWI and IWMI). CPWF also co-convened with SIWI and the Ramsar Convention a workshop on "Sharing the benefits of ecosystem services and the costs of ecosystem degradation".

CPWF International Forum on Water and Food (IFWF), November 2006: As already described in section 3.2.8, this was a major CPWF event for networking, synthesis and public awareness.

5. Governance and management

5.1 Consortium Steering Committee

The CPWF operates under a Joint Venture Agreement (JVA). Members of the agreement include five CGIAR centers; six NARES and one IRBO located in the river basins in which the CPWF operates; four ARIs, and three NGOs. One NGO, WRI, withdrew from the Consortium in 2006 as their research portfolio no longer included water and agriculture. The Members meet as a Consortium Steering Committee (CSC) comprising one representative of each Member organization. IWMI is the 'Leading Member' and the legal representative of the JVA. The CSC is an autonomous decision making body and does not report formally to any boards of the JVA Members to ratify decisions made by the CSC. The CSC meets once a year in person, and virtually as required for program operations. The 2006 meeting was convened in Cairo, Egypt through the invitation of the National Water Research Center, from 2 – 3 May. The main points for discussion and decisions at this meeting were the proposal for a second competitive call, including confirmation of identified priorities; the review and ratification of lead institutions selected from the 'expression of interest' process of BFPs; and plans for the International Forum on Water and Food.

5.2 Program Management Team

The Challenge Program Management Team (CPMT) continues to work effectively and harmoniously as a team of six people including the Program Coordinator and Program Manager, two members from the broader community of CPWF consortium institutions and project researchers, a representative from the theme leaders (TLs) and one from among the basin coordinators (BCs). The team meets in person at least four times a year, generally at the time of a CPWF initiated workshop (such as the CPWF Asia Project Leader's meeting in Vientiane, Lao PDR in February 2006, and the CSC meeting in Cairo, May 2006), or at international fora where the CPWF is actively participating (such as the Stockholm World Water Week in August 2006 and the International Forum on Water and Food in Vientiane, Lao PDR in November 2006).

5.3 Project Management

Under the Joint Venture Agreement, the five CGIAR centers are tasked with the substantive management of the project portfolio for which the centers can charge an overhead on contracted research of 4%. This includes administrative and management services, including reporting and project reviews to ensure quality and effectiveness of the research projects under the thematic area lodged within the center. An MOU between the CPWF and the Managing Centers sets out the procedures under which the projects should be managed to ensure equity across the five

centers. A meeting was convened in August 2006 of the centre representatives who provide these management services, and the CPWF Secretariat in order to revisit the procedures and identify where efficiencies of operation can be made, and to enable the centre representatives to become more familiar with the rationale behind the procedures.

5.4 Operational issues and challenges

Updating procurement guidelines

On 18 September 2006 the Director of the CGIAR commissioned an independent external audit of the selection process for BFPs, so as to investigate an anonymous allegation that the selection process was biased. On 16 October we received the report of the external auditor together with a statement that the CGIAR Secretariat fully supported its conclusions and recommendations. The report was analyzed by the CPWF Steering Committee which reached its decision on 20 October to accept the report and its recommendations.

The report found no merit in the anonymous allegations and no evidence of any wrong-doing by the CPWF. It also found that the process of BFP selection was logical, broadly consistent with generally accepted principles of procurement, including World Bank guidelines, and that all key decisions were duly approved by the Steering Committee. However, the auditor considered that the CPWF had no ex-ante procurement procedure, nor did it comply with *CGIAR Financial Guideline 6* (that refers to procurement of goods and services) and that critical elements of detail, including "some which are subtle and easily overlooked", were lacking.

In view of these findings, the external auditor recommended cancelling the BFP 2006 competitive call that had reached the stage of contract negotiation. In the case of this second competitive call, the auditor recommended that the competitive process be paused to request the input of a procurement expert to ensure that it closely followed all aspects of procurement practice required in the *CGIAR Financial Guidelines*.

The CPWF was advised to implement additional controls before it proceeded with any further competitive bidding. The controls required include a process for public opening of electronic bids, the inclusion of the draft contract as part of the bidding documents, the inclusion of an explicit complaints process, and the design of a process for secure electronic submissions and communication with reviewers and steering committee. These will strengthen processes (and prevent difficulties such as those experienced in the anonymous allegations) not just for the CPWF, which is a pilot program, but potentially for all Challenge Programs and for the CGIAR as a whole, should there be wider adoption in the system.

The CPWF Program Manager worked closely with a World Bank procurement specialist and other advisers within the CGIAR for the remainder of 2006 to prepare documents in which CPWF outlines how its competitive procedures deviate from the CGIAR Financial Guidelines No 6 (FG6). The Program also submitted an explanation of the implications for the second call and Basin Focal Projects.

At the time of writing of this annual report, CPWF had received approval of the deviations from both the CGIAR Secretariat and the CPWF Consortium Steering Committee. The Call for Expressions of Interest for Basin Focal Project Lead Institutions was issued on 16 March 2007 and the Second Competitive Call for Proposals resumed June 2007.

Partnerships

Rich and diverse partnerships continue as the motor of CPWF work and sometimes produce surprising results in the conduct and interpretation of the scientific research through the unexpected interactions of partners with very different backgrounds and approaches.

More than 200 different institutions participate officially in CPWF projects, providing expertise through agreements established by memoranda of understanding with the project lead institutions. Present estimated distribution of project funding is unchanged since the last report (not including central activities – themes, basins and secretariat): 45% NARES, 41% CGIAR, 9% ARI, 5% NGO. The 2007 – 2009 Medium Term Plan provides more information on partnerships that exist across the project portfolio and within the river basins.

Meetings of project leaders and researchers are an important mechanism for discovering and forging linkages among CPWF project researchers. In 2006, successful regional meetings of project leaders were held in Asia (February 2006), and in Latin America (October 2006) to complement one held in Africa in November 2005.

The partnership with the Comprehensive Assessment of Water Management in Agriculture (CA) continued to be of particular importance. The CA-CPWF summary of priorities and scenario predictions for CPWF basins have been finalized. The CA leader has also been active as an external advisor in guiding the CPWF about the content and approach of the second phase of the Program.

6. Finance

6.1 Financial objectives and outcomes

The Consortium Steering Committee approves the CPWF budget on an annual basis. Table 6.1 presents the donor contributions received to end 2006 from all donors

In September 2006, thanks to the efforts of the Limpopo Basin Coordinator and the NGO FANRPAN, CPWF's work in Africa was formally confirmed as being fully congruent with the agricultural research priorities of the New Partnership for Africa's Development (NEPAD) and CPWF received a commitment that they will support us now and in our second phase with donors and others, regionally and internationally. This vital endorsement opens up several opportunities for funding by donors who are strongly guided by NEPAD's priorities.

The Program continued specific contacts with all other CPWF donors, especially DfID, the European Commission, France (Echel-Eau) and the World Bank, contributing in the case of DfID to a submission to the UK Secretary of State.

Donor commitments and projects are generally in good shape..

6.2 Schedule of contributions received

Table 6.2 presents receipts and expenditures of the program up to December 2006. The figures reflect the externally audited account statements.

6.3 Resource allocation/expenditure (by sub-programs; Priority area, object of expenditure)

Please see table 6.2 also for a full account of resource allocations for 2006, and audited expenditures for previous years.

Other issues on financial management

The report of the external auditor stated that the CPWF structure and procedures contained inherent problems of conflict of interest at all levels in the management and governance of the Program. As a result of the consultation with the World Bank procurement specialist, the CPWF was advised that this included the role of managing centers in overseeing the financial management of projects that were undertaken by project leaders within their own institute. While this is normal practice in the system, as centers have been managing their donor contributions since the inception of the CGIAR, we were advised that it would be desirable to adopt a different strategy[37]. For this reason, as well as experience showing that while the procedure is desirable from a partnership perspective, there were issues of unnecessary complexity, the financial management of projects is now conducted by the CPWF Secretariat. This has the added advantage of being able to produce more rigorous financial data for Program management and governance needs.

As a result of this procedural change, the CPWF Standard Clauses and Procedures were rewritten. This provided the opportunity to adopt a new audit approach that had been under consideration by the CGIAR Internal Audit Office during 2006. The new procedures allow for an annual threshold of USD 500 000 under which no external audit statement is required, . This will enable future disbursements to be reported as expenditures to provide greater clarity in the financial status of the Program. Provision is also made for contracted institutions that have a different financial year to the CGIAR system to provide interim statements, with the subsequent formal statement provided at the time of the normal audit cycle. This prevents institutions having to invest resources in audits specifically for one Program.

[37] A similar concern was mentioned in the case of M&E by theme leaders and basin coordinators of projects lodged in their own institute.

Table 6.1 Donor Contributions

	Brought US$ '000	Funds US$'000	Actual US$ '000	Balance US$ '000
Year 2002				
World Bank	-	200	200	-
World Bank	-	1,500	432	1,068
Total	**-**	**1,700**	**632**	**1,068**
Year 2003				
Danish (DKK 3,000,000)	-	497	273	224
Netherlands (€ 1,500,000)	-	1,829	1,219	610
Norway (NOK 2.5m)	-	347	347	-
Sweden [SIDA] (SEK 800,000)	-	107	107	-
Switzerland [SDC] (CHF 500,000) - 2003	-	386	386	-
Switzerland [SDC] (CHF 800,000) - 2004	-	632	-	632
USDA	-	-	68	(68)
World Bank	1,068	1,500	2,555	13
Total	**1,068**	**5,298**	**4,955**	**1,411**
				-
Year 2004				
Danish (DKK 2,100,000)	224	363	-	587
DFID (£ 1,250,000)	-	2,267	1,746	521
France (Euro 2,000,000)	-	2,668	-	2,668
GTZ (€ 350,000)	-	433	47	386
Netherlands (€ 537,357)	610	653	959	304
Norway (NOK 3m)	-	441	441	-
Sweden [SIDA]	-	-	58	(58)
Switzerland [SDC] (CHF 800,000) - 2004	632	-	526	106
USDA	(68)	68	-	-
World Bank	13	2,500	-	2,513
Total	**1,411**	**9,393**	**3,777**	**7,027**
Year 2005				
Danish (DKK 2,100,000)	587	332	333	586
DFID (£ 1,250,000)	521	2,399	2,921	(1)
DFID (£ 1,250,000) New	-	2,196	1,550	646
France (Euro 2,000,000)	2,668	-	9	2,659
GTZ (€ 350,000)	386	-	386	-
GTZ (€ 300,000)	-	350	114	236
Norway (NOK 2.5m)	-	371	150	221
Netherlands (€ 254,822)	304	315	309	310
Sweden [SIDA] (SEK 683,334) - 2004	(58)	104	46	-
Sweden [SIDA] (SEK 690,000) - 2005	-	85	85	-
Switzerland [SDC] (CHF 1,300,000) - 2005	106	1,041	583	564
World Bank	2,513	2,000	3,161	1,352
Total	**7,027**	**9,193**	**9,647**	**6,573**
Year 2006				
Danish (DKK 1,700,000)	586	302	569	319
DFID (£ 2,500,000) New	645	4,562	5,207	-
France (Euro 530,000)	2,659	654	581	2,732
GTZ (€ 350,000)	236	443	335	344
Norway (NOK 2m)	221	320	541	-
Netherlands (€ 99,634)	310	127	437	-
Sweden [SIDA] (SEK 700,000)		98	49	49
Switzerland [SDC] (CHF 1,300,000) - 2006	564	1,050	1,614	-
World Bank	1,352	2,700	4,037	15
Total	**6,573**	**10,256**	**13,370**	**3,459**

Table 6.2: Receipts and expenditures						
	2002	**2003**	**2004**	**2005**	**2006**	**Total**
	US$'000	**US$'000**	**US$'000**	**US$'000**	**US$'000**	**US$'000**
Income						
World Bank	200	3,000	2,500	2,000	2,700	10,400
Netherlands		1,829	653	315	127	2,924
France			2,668	-	654	3,322
Norway		347	441	371	320	1,479
Switzerland		385	632	1,041	1,050	3,108
Sweden		107	104	86	98	395
Denmark		497	363	332	302	1,494
Germany			433	350	443	1,226
DfID			2,267	4,595	4,562	11,424
USAID (USDA)			68			68
Total income	**200**	**6,165**	**10,129**	**9,090**	**10,256**	**35,840**
Expenditure						
Program Support						
Program development	300					300
Secretariat	100	635	499	441	484	2,159
Total program support expenditure	**400**	**635**	**499**	**441**	**484**	**2,459**
Research						
First call			1,108	6,559	7,502	15,169
Small grants for impact					563	563
Basin focal projects				466	1,579	2,045
Program activities	232	1,504	545	344	1,083	3,708
Capacity building		-	18	53	195	266
Theme leaders		1,346	793	742	1,021	3,902
Benchmark basins		1,470	792	842	707	3,811
Research administration			22	200	236	458
Total research expenditure	**232**	**4,320**	**3,278**	**9,206**	**12,886**	**29,922**
Total expenditure	**632**	**4,955**	**3,777**	**9,647**	**13,370**	**32,381**
Surplus(/Deficit)	(432)	1,210	6,352	(557)	(3,114)	3,459
Balance brought forward	-	(432)	778	7,130	6,573	
Balance carried forward	(432)	778	7,130	6,573	3,459	

Lessons learnt during the first phase of the Challenge Program on Water and Food (CPWF) 2003-2007

Compiled by the Program Coordinator from contributions by CPWF management and coordinators, September 2007

Value added through CPs

- Many project researchers are grateful that the CPWF has given them the opportunity to test innovative ideas or cross-scale research that was not within the scope of their home institutions.
- The admirable target that the CPs are pillars to test CGIAR reform as well as for focused science must be accepted explicitly and clearly by CG centers, otherwise energy and investment is wasted in covert CG center competition with, and opposition to, CPs; for their part, CPs must be sensitive to centers' needs and explore stepwise change that builds on centers' experiences.
- Synthesis of results from different CP projects and activities is vital but difficult to achieve without proactive gathering of information and agreement about the information required.
- To recognize and build on value added, a specific effort is necessary to build the visibility and identity of each CP, including strict requirement for crediting the program and using its logos; this is necessary to encourage others to contribute to and support a CP network that they may not even realize exists if individual institutions do not share the credit, or treat the CP as though it were "another funding agency" rather than a scientific joint venture.

How to get the best science from a broad CP community

- CPs may be dealing with many of the same science questions as IARCs have done before, with NARES support. However, the breadth of partnership, and giving more leadership responsibility to non-CG partners, often changes the way the science questions are handled (in the case of the CPWF, better attention to integration, attention to scale issues, connection to policy making, impact is being given).
- "When new partnerships form, new paradigms, and even science, emerge that could never have been achieved by the individuals alone. It is 'trans-disciplinarity', much more than simply having people of different disciplines working together. Completely unexpected information and understanding have emerged when diverse CPWF participants meet, leaving behind their pre-conceived disciplinary or institutional notions, biases and knowledge" .
- In a complex new CP, with a time horizon of 10-15 years, as much time may need to be spent on process and team building as in definition of the science. This reflects the fact that CPs change the way of doing things among people as much as they change the science. Process should not be criticized as somehow inferior to science, as can happen in the CGIAR community. Insufficient initial attention to process will almost certainly lead to problems for science development.
- Make sure that the information reaches those in the science community as well as others that can produce and use science for development; identify ground-breaking pioneers in application of research to development and share new knowledge with them.

How to achieve and manage broad partnerships

- CPWF opened up opportunities for national institutions to participate as equal partners, contributing to and even leading research projects.
- It is easier to maintain existing partnerships (which could be taken to new levels of interaction or cover new content) than it is to build new ones; new partnerships need planning and

monitoring through network analysis and may then yield more innovative inputs than existing partnerships.

- Dispersed scientific networks in a CP can work via virtual communication; however, personal face to face contact is important, especially for interaction where pre-conceived notions are left behind; communication tools such as a regular newsletter can back this up to help people identify with a community of practice. CPs need to develop (and are developing) a virtual equivalent of "brainstorming" and of spontaneous meetings to deal with specific urgent issues.
- Investment in networks should be regarded as investment in more effective science and not as transaction costs; it is not usually feasible to foresee exactly what the role of each partner will be in a partnership, although there are common-sense rules of thumb about how to limit duplication among partners.
- The maintenance of effective partnerships requires tact and negotiation. It is easier to find an effective role for all partners if responsibilities are assigned at different levels (such as project activity, project oversight, basin or theme coordination, program management).
- Members of national and international institutions within a CP team can guide each other about the characteristics and needs of other partners.

Building a cross-cultural, cross-institutional coordination team

- CPWF has succeeded in consolidating a cross-institutional, cross-cultural team. However, this takes time when the members are dispersed. Problems are overcome when there is the will to do it. Patience is required at times.
- Efficiency and inclusiveness in discussion/decision making are potentially conflicting needs. Team members from different institutional and national cultures (even among different CG staff, for example) may have different expectations about what time investment is valid.
- The investment is, however, worth it because of the greater breadth of understanding achieved.
- In complex inter-institutional teams, it also takes time to define and implement roles and responsibilities.
- Obtaining balance (of disciplinary experience, gender, etc) can be difficult in a group where each institution nominates its own representative (subject only to no-objection by the other members); the CPWF has gradually reached agreements whereby CPWF management participates in the selection process run by each independent CGIAR centre; we still lack this agreement with non-CGIAR institutions.
- Good coordination and leadership is key for effective team work and realization of goals.
- Discipline and accepted team standards in responding in a timely manner (especially through virtual communication) are important and, at the start, difficult areas to achieve.

Governance and management

- The appropriate division of responsibilities among steering committee, management team, technical coordinators, secretariat and individual management team members may change as both the CP and its members mature.
- For a CP to use the mechanism of competitive grants, its governance structure must remove any appearance of conflict of interest in research selection; if this cannot be achieved, it may be better in the current environment to avoid the use of competitive processes. The attractive "mixed" model, in which a group (or consortium) of institutions agree to conduct research and invite others to compete with them for funds, is apparently untenable under typical procurement rules. Innovative design with open minded experts from many fields is required so as to re-establish the possibility of this valuable model.
- Split appointments, between CP and the host institution, are best avoided because they make loyalty and availability particularly difficult in complex CPs. Staff provided by different CP member institutions should dedicate 100% of their available (full or part time) appointment

to the CP. CP management must have primary responsibility for performance evaluation, taking into account the procedures of each institution that offers staff, otherwise effective management is impossible.

- CPs should be hosted at locations where high quality, affordable support is available and where conditions are suitable for the frequent, global travel of CP international staff (which can be more and more wide-ranging than for typical CG staff).
- It may be better to have an independent base in an institution with a rather different mandate rather than sharing an address with a well known host CG centre that works in a similar field, so as to avoid confusion in "branding" the CP and the centre and to avoid perceived conflicts of interest.
- Even though the research field may need dividing into different areas and responsibilities, specific arrangements and individual responsibilities for integration should be designed from the start of the CP, to avoid the creation of silos connected to existing institutions
- The model of contracted projects run by independent institutions (CG and other) under their own monitoring mechanisms appears to be too loose in supervision to obtain the focused timely results required of a CP; more direct (or delegated) supervision by the CP management itself is needed.

Designing and running competitive processes

- Competitive processes are very effective in "opening up" the research agenda to new suppliers and stimulating new partnerships.
- They are less effective, if used alone, in covering in a balanced way a large set of priorities, research themes, geographical target areas, types of lead institution, etc. (note that introduction of any "quota" system effectively limits competition by merit).
- The contracts arising out of competitive processes make it difficult to negotiate substantial adjustments in research plans so as to respond to new developments or knowledge that arise later; combining the best institutions and ideas from two or more projects in a competitive call would often provide the best research design, but is typically (and most unfortunately) prohibited by procurement rules.
- A battery of process tools with different levels of competition, from direct commissioning, through competitive tendering, to open competition, may be required to address research areas with different availability of research providers.
- CGIAR centers may react less favorably to CP competitive processes than other institutions, apparently because of perceptions that (a) the CP funds "ought to be redistributed" among the CG centers or were "diverted" from centre budgets (which is not the case) or (b) because CP administration is perceived as more accessible to protests than donor funding mechanisms would be.
- Procurement and audit specialists must not be allowed to be the sole arbiters of the design of competitive processes; they usually do not have the necessary understanding and experience of the needs in research for development, nor of the difference between research and the standard procurement of goods and services.
- Reviewers for proposals (competitive or commissioned) should include both international experts in the thematic area and those familiar with the particular region or country/countries where the research is to be conducted.
- The results of any peer review process are likely to be unacceptable to some proponents. The greater the level of specialization of the research proposals, the more demanding it is to find independent reviewers of sufficient caliber, and the more likely it is that proponents will be dissatisfied.
- Relatively broad priorities may be useful in establishing broad participation in the first call of a CP competitive process; refinement and focusing of priorities, combined with use of a range of selection mechanisms (see above) may be better as the program matures.
- Many researchers, including those in CG centers, are not accustomed to estimating the cost of their research time. In processes that require costed proposals to be presented

(competitive or not) accusations of "bureaucracy" may arise because researchers are disconcerted by this need for greater accountability.

Funding and cost

- CPs can offer a reliable selection and management process for specialist proposals (water and food research in the CPWF case), thus saving time and investment for individual donors who do not then need to run their own specialist process.
- Individual donor preferences for regions, research themes and approaches can be handled within a broader range of program research priorities, without necessarily running separate calls for each donor. Whatever method is used, consistent rules should be applied in order to ensure transparency.
- It is necessary to find an acceptable balance between more modest funding limits per proposal (disadvantage – each proposal is more limited in the breadth of institutional participation it can attempt) and higher funding limits per proposal (disadvantage – fewer proposals can be funded and therefore more groups of proponents may be excluded)
- The CGIAR should decide whether it wishes CPs to be innovative reform programs with relatively light control structures, or whether they should be subject to the same controls as CGIAR centers (MTPs, performance measurement system, etc) in which case small streamlined secretariats are not possible; at present CPs produce most of the control outputs required of CGIAR centers with and estimated 20-25% of the staff dedicated to these tasks compared to a CG centre.
- It is difficult in CPs to combine time-bound, project-like phases (that assign research funds through projects) with the potential uncertainty of year-to-year funding as experienced by the CG centers. This combines the most difficult aspects of project management (the need to produce definite outputs by determined deadlines) without obtaining the advantages (a time-bound budget that is known in advance)

Building and managing a complex program

- One of the hypotheses about CPs is that their complexity is a potential virtue worth testing – particularly the benefits of directly linking CGIAR research with a wide range of other institutions.
- The process of building each CP therefore requires time because of this desirable complexity. The CPWF is particularly complex. Each part of our structure - basins, themes, projects and institutional arrangements - is in itself complex.
- In a complex CP, design is iterative and we should be happy to learn from our mistakes.
- In a new CP, we need to strike the balance between sufficient simplicity to get started and sufficient complexity so as to experience the special characteristics of a CP.
- Although a CP may be complex, we should strive wherever possible to simplify its processes.
- Global problems need global scope; yet moving forward on many broad fronts can be slow and may dilute progress in any one. Thus it is necessary to focus among the possible fronts of action, while maintaining an integrated vision.

Impact

- Existing CPs have shown the potential for development impact through their broadened partnerships in research for development.
- In order to achieve the development impact from focused research that is expected from CPs within a tight time frame, the Science Council should re-evaluate its previous rejection of research with local impact; in the end, all large scale impact as international public goods must first grow from local testing and impact. Without this openness, NGO and other development partners will not be able to work effectively with CPs.

- On account of the complex social and political issues involved in the process, the time frame and the assumptions for achieving impact should be set realistically.
- CPs should resist the temptation to establish over-ambitious program goals and objectives to which they cannot contribute significantly.
- Analysis of impact pathways is a methodology that is becoming increasingly important in bridging the gap between research and development.
- Uptake pathways need to be established and periodically revised so as to monitor the progress of research.