## Project

**Optimising Canal and Groundwater Management to Assist Water User Associations in Maximizing Crop Production and Managing Salinisation in Australia and Pakistan**

### Project Details

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<th><strong>project number</strong></th>
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<td><strong>period of report</strong></td>
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1 Progress summary

The project activities for the period of report from Jun 1, 2009 - May 31, 2010 are given in this report. The project builds on the strong track record of different federal and provincial organizations in participatory irrigation management, particularly, the current initiatives by Government of Punjab through Punjab Irrigation and Drainage Authority (PIDA), Punjab-Pakistan, who is working closely with the Farmer organisations (FO) under the ongoing institutional reforms in the command area of Lower Chenab Canal (LCC) in Pakistan. This project thus link to different federal and provincial organizations responsible for irrigation management, and the extension services for participatory demonstration, evaluation and exploration of adoption pathways regarding promising on-farm water saving technologies already developed (e.g. laser-leveling; raised beds; zero-till planting etc.) elsewhere by the project team.

This project will develop and use, for the first time in the history of canal and groundwater management in Pakistan, the hydrologic-economic modelling tools capable of scenario analysis of water distribution as a function of crop-groundwater-soil mix at farm and "distributary" and "minor" canal levels both in the LCC and Coleambally Irrigation Area (CIA). More importantly, the project will couple Remote Sensing tools and hydrological data with socioeconomic data for developing the surface and ground water supply and demand management options at various spatial scales, for tailoring water sectors adaptations to climate change.

Currently PIDA is involved with 85 FOs for demonstrating improved irrigation practices in the LCC. The tail-end and farmers often get less water due to inequity in access to surface water; they also have poor quality groundwater, such that the use of poor quality groundwater alone for irrigation reduces crop yield and production, causes salinity and thus have serious socioeconomic and environmental implications. These farmers need scientific information for "conjunctive use" of surface and groundwater for optimising their productivity and returns to limited land and water resources.

In order to get new and reliable hydrological data, the project team has installed 54 new piezometers, 3 soil moisture probes and an automatic weather station at selective locations within the distributaries in LCC. Other hydrological parameter including water quality has been collected on ongoing basis and is being processed in LCC. PIDA staff has recently calibrated the gauges and accurate flow data will be made available to the project team. Historical data on canal flows across the LCC system have also been collected. These data will be used for the development of surface and ground water model using MODFLOW. In September 2009, the project team has carried out extensive ground truthing campaign over two weeks to get information about land use and land cover classification in LCC.

During December-January 2010, the project team launched a major campaign for data collection under the socio-economic component of the project. Two-weeks training was provided to 16 project team members from Pakistan on field data collection, and one-week training to another 8 team members on data entry, coding and de-coding, data management, and panel data protocols and analysis. The socio-economic component of the project will collect panel data from 720 households through a structured questionnaire, visiting each household twice (in the beginning (2009) and end (2012) over the course of the project to generate comparable data to be collected on the same format to allow robust analysis and scenario planning. This data module 8 include: Basic Information Module; Infrastructure Module; Agricultural Production Module; Expenditure Module; Credit Module; Groundwater and Energy Module; Retrospective Questions Module; and Climate Change and Poverty Module.
This data also covers access to groundwater; community perspectives on climate change; socioeconomic drivers impacting food security and poverty; and focus group interviews and workshop with key stakeholders across the four provinces of Pakistan.

Professor Iqrar A Khan, Vice Chancellor, University of Agriculture, Faisalabad – Pakistan awarded certificates of participation among the trainees at the completion of the training. The Annual project workshop was held on January 11, 2010 and was inaugurated by Professor Iqrar Khan, Vice Chancellor, University of Agriculture, Faisalabad - Pakistan. Australian and PC project team gave detailed presentations on ACIAR project activities-2009 in Australia and Pakistan. About 60 key stakeholders participated in the workshop. The ACIAR project has thus been instrumental in mobilising resources and high-level stakeholder networking and engagement.
## 2 Achievements against activities and outputs/milestones

**Objective 1: To develop tools capable of analysing hydrological and economic water management trade-off scenarios using spatial crop, soil, water availability and water quality data**

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<tr>
<th>No.</th>
<th>Activity</th>
<th>Outputs/ milestones</th>
<th>Completion date</th>
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<tr>
<td>1.1</td>
<td>Collect and synthesise data regarding irrigated crops, water distribution, groundwater uses, soil physiography, aquifer characteristics, and cropping pattern in the command area of the LCC in Pakistan and CIA in Australia</td>
<td>Discussion paper drafted for CIA and CSU and Pc team team is working on Chapter/discussion paper on LCC</td>
<td>Jan 2010</td>
<td>Conference paper on LCC has been presented: Hafeez, M., Hanjra, M. A., Ullah, K., Bodla, H.U. and Ahmad, R.N. Surface and Groundwater Contribution in Convering with High Crop Water Demand in Indus Basin, EGU General Assembly 2010, Vienna, Austria. Discussion paper on CIA has been drafted: Hafeez, M., Chemin, Y. and Rabbani, U. Spatial Observation and Models for Crop Water Use in Australia, American Geophysical Union Fall Meeting 14-18 December 2009, San Francisco, USA. Discussion paper on LCC, in progress, to be completed by August 2010 and published as book chapter: Rai N.A., 2010. WatSave interventions in Pakistan agriculture. Under review for publication in the book “Knowledge Sharing on Water for Food Security in Asia” Springer. Delays in implementing the project activities, and ongoing operational problems that required re-selection of some study sites in LCC in consultation with PC, delayed the work on the above two discussion papers/chapter.</td>
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Two journal papers that have been submitted for review and publication in the special issue on Knowledge Sharing on Water for Food Security are:

1.2 Collect and synthesise facts and figures from existing data sources and available reports for the LCC and CIA. Preliminary report drafted Jan 2010

CIA component has been completed and the remaining work is at an advanced stage, and CSU team is working on the LCC component (see location map of the project). Data on peizometers and other hydrological parameter has been collected and is being processed; soil moisture probes have been installed in all three study areas in LCC. PIDA staff has recently calibrated the gauges and accurate flow data will be made available to the project team. Historical data on canal flows across the LCC system have also been collected. Automatic Weather Station has been installed in LCC as well. These data will be used for the development of surface and ground water model using MODFLOW. Remote sensing data from MODIS and ground truth campagnas have also been acquired, for coupling with socioeconomic data to be collected by 8 rounds throughout the life of the project.

1.3 Develop database of irrigated crops, water distribution, groundwater uses, soil physiography, aquifer characteristics, and cropping pattern in the LCC and CIA. Initial database developed May 2010

Initial database developed and further database development is in progress. The database development for CIA is complete and real time water supply and demand forecasting model is being developed and calibrated. Similar model will be developed for CIA. The PC team was provided hands-on training on socioeconomic data modules, data entry, pre-processing, and economic analysis using Excel and SPSS softwares. Special training was provided to 8 team members (including 6 female members to ensure gender inclusion) on panel database development, retrieval, security and sharing among the team members. This training was widely appreciated by the Vice Chancellor and PC team leaders. Future trainings are planned as requested by PC. The database will be accessible to project partners through the Web as well as FTP protocol, for ease of data sharing, compilation, and analysis. Data collected from LCC will be posted on dedicated website to be maintained by PIDA and UAF jointly. Project team will have a dedicated log-in to allow unfettered access to all project data and activities. Data on socio-economic component of the project will also be posted on the dedicated website. Key findings on socio-economic issues impacting water use efficiency and water productivity in the LCC and its implications for future security and environmental sustainability will also be posted in public domain to enhance stakeholder access and engagement.

PC = partner country, A = Australia
Objective 3: To support PIDA and Farmer Organisations in the implementation of more equitable, economically efficient and hydrologically sustainable canal and groundwater management options in the study areas.

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<th>No.</th>
<th>Activity</th>
<th>Outputs/milestones</th>
<th>Completion date</th>
<th>Comments</th>
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<tr>
<td>3.1</td>
<td>Conduct separate interviews and workshops with community participants and groups of ‘experts’ to better clarify the major issues in canal and groundwater management.</td>
<td>Interviews and workshops involving discussions with community participants and groups of ‘experts’ were held in CIA and LCC.</td>
<td>May 2010</td>
<td>This activity has been fully achieved. A/Prof. Mohsin Hafeez and Munir A. Hanjra visited the project area and held interviews and workshops involving discussions with community participants and groups of ‘experts’ (see photograph below) in January 2010. During a follow up visit by the project team led by A/Prof. Mohsin Hafeez also held further discussion with key experts in March 2010. The project leader met with key group of experts working within the water management sector in Pakistan to brief them about the ACIAR project, to learn about other ongoing projects and to get better clarification in canal and ground water management projects. The project workshop was inaugurated by Professor Iqrar Khan, Vice Chancellor, University of Agriculture, Faisalabad - Pakistan. A/Prof. Mohsin Hafeez, Habib Ullah Bodla and Professor Rai Niaz gave detailed presentations on ACIAR project activities-2009 in Australia and Pakistan during the morning session (January 11, 2010) where as focus group discussions and synthesis presentations thereof were held in the afternoon session, including: Socioeconomic Analysis Group: synthesis presented by Munir A. Hanjra, CSU Hydrological Modelling Group: synthesis presented by Professor Zulfiqar Ahmad, Quaid-i-Azam University, Islamabad Irrigation Management Group: synthesis presented by Dr Sadiq Shafique, (Ex) Irrigation Management Specialist at IWMU Up-scaling and Extension Group: synthesis presented by Professor Bakhshal Lashari, Mehran UET, Sindh Policy Implications Group: synthesis presented by Mushtaq A Gill (T.I) Director General (Ex), Water Management, Punjab: Executive Director South Asian Conservation Agriculture Network (SACAN) To better clarify the major issues in canal and groundwater management, and impact assessment at the completion of the project, panel data from 720 households (PC), mainly farmers but also non-farm households, on socioeconomic factors will be collected twice a year, throughout the project period, using a detailed questionnaire having the following modules: 1. Retrospective Questions Module 2. Basic Information Module 3. Irrigation Infrastructure Module 4. Agricultural Production Module</td>
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<td><strong>8. Climate Change Module</strong></td>
<td><strong>This data on baseline socioeconomic conditions and end-of-project conditions will enable impact assessment for the project, to successfully demonstrate, evaluate and explore adoption pathways regarding promising on-farm canal and groundwater management strategies, and water saving technologies.</strong></td>
<td><strong>This data on baseline socioeconomic conditions and end-of-project conditions will enable impact assessment for the project, to successfully demonstrate, evaluate and explore adoption pathways regarding promising on-farm canal and groundwater management strategies, and water saving technologies.</strong></td>
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<td><strong>3.2 Organise a joint year-end workshop to resolve differences between the 'experts' and farmers</strong></td>
<td><strong>Report prepared on the stakeholders’ perceptions regarding the major issues in canal and groundwater management</strong></td>
<td><strong>May 2010</strong></td>
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<td><strong>This activity has been partially achieved. Findings from previous interviews and workshops have been used to re-select one irrigation distributory as project site (PC) and better plan the year-end workshop. For assessing the stakeholders’ perceptions regarding the major issues in canal and groundwater management, a joint year-end workshop has been planned for end of 2010 (PC).</strong></td>
<td><strong>PC = partner country, A = Australia</strong></td>
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<td><strong>3.3 Analyse and synthesise findings from interviews and workshops.</strong></td>
<td><strong>Report prepared on the findings from interviews and workshops.</strong></td>
<td><strong>May 2010</strong></td>
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<tr>
<td><strong>This activity has been partially achieved. Findings from previous interviews and workshops have been synthesised. Findings from a joint year-end workshop, and survey data from 720 households will be synthesised.</strong></td>
<td><strong>PC = partner country, A = Australia</strong></td>
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Location map of the ACIAR project area in Australia

Location map of the ACIAR project area in Pakistan
Socioeconomic data collection involving field training and discussions with community participants and groups of ‘experts’ held in LCC, Jan 2010 (Visible are Munir A. Hanjra, CSU team; and male members of PC field data collection team (left) and PC female team members (right)).

Professor Iqrar A Khan, Vice Chancellor, University of Agriculture, Faisalabad – Pakistan awarded Certificate of Participation to the trainees of socioeconomic data collection and analysis group at a formal dinner at the completion of the training. More than half of the 24 team members who successfully completed the training and participated in the socioeconomic data collection program in January 2010 are females.
Field visit and interviews involving discussions with FO and community participants and groups of ‘experts’ held in LCC, Jan 2010 (Visible are A/Prof. Mohsin Hafeez and Munir A. Hanjra, CSU team; and Niaz A. Rai, Habib U Bodla - PC team).

ACAIR Annual Project Workshop held at University of Agriculture, Faisalabad, Pakistan in Jan 2010. Visible are key stakeholders and national experts.

Federal Minister Rana M Farooq Saeed Khan and CSU team members A/Prof. Mohsin Hafeez (Project Leader) and Munir A. Hanjra after discussing the potential engagement of CSU team in water pollution issues and its impacts on human health and agricultural productivity, in January 2010 during the Seminar in Islamabad, Pakistan. Visible are high level officials, national scientists working of Water and Climate Change in Pakistan,
international participants and other stakeholders including higher degree research students and NGO members.
3 Impacts

3.1 Scientific impacts

This project will develop and use, for the first time in the history of canal and groundwater management in Pakistan, the hydrologic-economic modelling tools capable of scenario analysis of water distribution as a function of crop-groundwater-soil mix at farm and "distributary" and "minor" canal levels both in the LCC and CIA. More importantly, the project will couple Remote Sensing tools and hydrological data with socioeconomic data for developing the surface and ground water supply and demand management options at various spatial scales, for tailoring water sectors adaptations to climate change.

Using participatory approaches, the project will also assist Farmers Organizations and PIDA staff for demonstrating and evaluating adoption pathways as listed below:

(i) promising on-farm canal and groundwater management strategies that would ensure more equitable, economically efficient and hydrologically sustainable distribution; and

(ii) on-farm water saving technologies already developed elsewhere (e.g. laser-levelling; raised beds; zero-till planting etc.).

This project has the potential to highlight the tradeoffs in canal and groundwater management in terms of the impacts on resource quality, income and livelihoods, socioeconomic impacts as well as "energy footprint" and "carbon footprint" in addition to the "water footprint". This will need incorporation of Remote Sensing data with baseline socioeconomic data, to be collected through in-person interviews using a detailed questionnaire having 8 Modules throughout the life of the project for socioeconomic impact assessment. The coupling of household level socioeconomic with the remote sensing and biophysical data will be the first in PC and has rarely been done anywhere else. This will have significant scientific impacts by advancing the academic and scientific capacity of the PC team.

The project will also make use of the existing models for optimising land and water management decisions at farm level. MODFLOW/MT3D is a modular 3-dimensional ground water flow model and is capable of modelling groundwater flow and salt movement at the farm and canal command level. MODFLOW will be used for modelling the sub-regional supply (canal) surface and groundwater interactions. Data from extensive piezometric networks will be used to monitor water levels under each land use to calculate drainage values (mm/day) for each hydro-geologic unit in the LCC and CIA. Simulations will be carried out for all land uses within each land management unit.

3.2 Capacity impacts

CSU team has provided training to PC team on the use of GPS for the collection of geo-referenced data and the ground truthing of Remote Sending and satellite data, as well on the use of Electrical Conductivity (EC) meters for collecting data on water quality. CSU team is taking lead on the development of questionnaire for the collection of socioeconomic data, and will take the lead to provide training to PC staff in Pakistan, and will also lead the data collection campaign in July 2009.

During January 2010, the project team launched a major campaign for data collection under the socio-economic component of the project. Mr. Munir Hanjra provided two-weeks training to 16 project team members from Pakistan on field data collection, and one-week training to another 8 team members on data entry, coding and de-coding, data management, and panel data protocols and analysis. The socio-economic component of the project will collect panel data from 720 households through a structured questionnaire, visiting each household twice a year over the course of the project to generate 8-spells of
comparable data to be collected on the same format to allow robust analysis and scenario planning. The socio-economic component of the project has 8 modules:

1. Basic Information Module
2. Infrastructure Module
3. Agricultural Production Module
4. Expenditure Module
5. Credit Module
6. Groundwater and Energy Module
7. Retrospective Questions Module
8. Climate Change Module

Professor Iqrar A Khan, Vice Chancellor, University of Agriculture, Faisalabad – Pakistan awarded Certificates of Participation to the trainees at a formal dinner (see picture) hosted at the completion of the training. More than half of the 24 team members who successfully completed the training and participated in the socioeconomic data collection program in the field are females. ACIAR project thus achieved a key goal of gender inclusion as enunciated under the recent Australian government funding priorities. "This is a landmark achievement that will allow us unfettered access to female headed households to advance the goal of gender inclusion, as female team members can interact directly with the female respondents in the villages " said Professor Iqrar Khan in his remarks during the graduation ceremony. He also reiterated the need for similar trainings in the near future. A/Prof. Mohsin Hafeez (Project Leader) agreed that the Vice Chancellor’s remarks was reassuring for the project team to address the gender issues in the future capacity building programs. The project team also had detailed discussions on the future capacity building and research activities of the ACIAR project.

The PC team was provided hands-on training on socioeconomic data modules, data entry, pre-processing, and economic analysis using Excel and SPSS softwares. Special training was provided to 8 team members (including 6 female members to ensure gender inclusion) on panel database development, retrieval, security and sharing among the team members. This training was widely appreciated by the Vice Chancellor and PC team leaders. Future trainings are planned as requested by PC. These include socioeconomic component, and integration of socioeconomic data with remote sensing and GIS data.

The Annual project workshop was inaugurated by Professor Iqrar Khan, Vice Chancellor, University of Agriculture, Faisalabad - Pakistan. A/Prof. Mohsin Hafeez, Habib Ullah Bodla and Professor Rai Niaz gave detailed presentations on ACIAR project activities-2009 in Australia and Pakistan during the morning session (January 11, 2010) where as focus group discussions and synthesis presentations thereof were held in the afternoon session, including:

Hydrological Modelling Group: synthesis presented by Professor Zulfiqar Ahmad, Quaid-i-Azam University, Islamabad

Irrigation Management Group: synthesis presented by Dr Sadiq Shafique, (Ex) Irrigation Management Specialist at IWMI

Socioeconomic Analysis Group: synthesis presented by Munir A. Hanjra, CSU

Up-scaling and Extension Group: synthesis presented by Professor Bakhshal Lashari, Mehran UET, Sindh-Pakistan.
Policy Implications Group: synthesis presented by Mushtaq A Gill (T.I) Director General (Ex), Water Management, Punjab; Executive Director South Asian Conservation Agriculture Network (SACAN).

Focus groups and their synthesis findings were highly welcomed by the stakeholders, including farmers from the PC project area. About 60 key stakeholders participated in the workshop. Professor Bakhshal Lashari covered the water management perspectives from Sindh province where as Dr Zahid M Khan of Peshawar University participated from the NWFP province. A/Prof. Mohsin Hafeez and PC team members also participated in the Two-days (7-8 January, 2010) International Seminar on “Impact of Climate Change on Water Resources and Glaciers: Concerns and Challenges” organized by Department of Earth Sciences, Quaid-i-Azam University, Islamabad, Pakistan. They also had a discussion with Federal Minister Rana M Farooq Saeed Khan on CSU’s potential engagement in water pollution abatement issues and its impacts on human health and agricultural productivity. “Australia and IC Water can help us in a big way to address the water pollution issue impacting the livelihoods of our poor farmers and rural communities; we need your help and need it urgently Australia” said the Minister during his closing remarks at the Seminar. Both the project workshop and seminar were widely covered by the national newspapers and digital media.

AusAID has the pleasure of fielding the second phase of an in-country Rural Development Mission from 15 to 25 February 2010. The mission investigated in detail opportunities for enhanced AusAID engagement in the rural development and agriculture sectors identified in the first phase of the mission (November 2009), to develop a framework for Australian assistance in these sectors. As part of the mission, the team also undertook discussions regarding options for future Australian assistance in the area of social protection, including possible support for income support/social protection programs.

The mission was led by AusAID’s Rural Development Adviser, Mr Ian Kershaw and the mission met with PC project team members including Prof. Rai Niaz (Project co-coordinator) on Tuesday 23 February and also held discussion with Habib Ullah Bodhla (Project Coordinator) and other high level officials. Field Visit to the ACIAR Project site in LCC was another successful activity by the Mission. During the mission, the team also met with Mr. Habib-Ullah Bodhla (Project Coordinator) to gain better understanding of the work carried out under ACIAR project and also explored the possibilities for the future cooperation in strengthening capacity building needs in water sector. The mission really enjoyed their direct communication with the farmers, researchers, and irrigation managers.

The PC team co-coordinator Professor Rai Niaz Ahmad and A/Prof. Arshad Ahmed also attended the International Water Week 2010 (April 19-23) at CSU and presented his work encompassing the project work on: "Water saving techniques in irrigated agriculture".

Apart from the above high-level capacity building for the PC team members, a number of students have been linked with the project as listed below:

Ms Lubna Anjum - PhD on Remote Sensing for Water Accounting and Water Productivity Modelling at Watercourse to Canal Command and Catchment Scale (UAF Candidate)

Mr Umar Draz - MSc thesis on Pathways to Reduce the Energy and Greenhouse Footprints in Large Irrigation Systems in Pakistan (UAF Candidate)

Mr A Waqas - MSc thesis on Assessing the Performance of Large Irrigation System through Remote Sensing and Participatory Approaches (UAF Candidate)

Ms Sadaf Majeed - PhD thesis on Remote Sensing for Actual Evapotranspiration Modelling (UAF Candidate)

Mr M Adnan - PhD thesis on Remote Sensing for Land Use and Land Cover Classification (already secured an admission at CSU and will apply for John Alright Fellowship)
TBA - MSc thesis on Economics of Conjunctive Use of Surface and Groundwater in Response to Climate Change (UAF Candidate)

3.3 Community impacts

Increasing water scarcity threatens the sustainability of irrigated agriculture and hence the food security. Groundwater development has contributed significantly to food security and reduction in poverty in Pakistan. Due to rapid population growth there has been a dramatic increase in the intensity of groundwater exploitation leading to declining groundwater tables and deteriorating groundwater quality. In such prevailing conditions, the hydrogeologic and economic assessment of escalating groundwater exploitation have become of paramount importance. Keeping this in view modelling conjunctive use of surface-ground water to assess future groundwater trends in the Indus River Basin, Pakistan is of paramount importance.

The Murray-Darling Basin is experiencing worst drought since the records began. Water scarcity has become a core issue, important to the wellbeing of rural communities and irrigated agriculture. How irrigation and cropping technologies respond to the water scarcity and what are the costs of adaptation to climate change is another aspect that affects both the cost of on farm water management decisions as well the costs and potential benefits of water management. The profitability of farming and the value or market price of water into the future remains uncertain. This project aims to develop a science-based information base for understanding the impacts of changes in irrigation technology and cropping decisions.

3.3.1 Economic impacts

In Pakistan, the economic payoffs of applying optimising canal and groundwater management options will accrue from three main pathways:

Firstly, where economic optimisation is an implicit outcome, the aggregate value of crop production is likely to be higher than the current aggregate production. On an individual farmer basis, this might result in a few privileged farmers close to the canal not necessarily making gains or even losing some of their productivity and income, but proportionally more farmers standing to benefit through increased crop productivity and hence incomes further away from the canal - improved equity.

The second mechanism by which economic gains will be generated is by enabling a better return on the Government of Pakistan’s current investment in infrastructure rehabilitation and the lining of watercourses, as the improved delivery of water can be coupled to increased crop water productivity.

Thirdly, as the improved distribution of water is also explicitly designed to address the issue of salinisation, economic benefits are also likely to accrue through cost reductions arising out of a reduced need to rehabilitate or reclaim salt-affect irrigation lands. The order of magnitude of these economic benefits will be determined by comparing the "before Project" condition with "after Project" situation by using the socioeconomic panel data collected through household level survey, twice every year through the project life generating two spells of panel data on the same households over 4-years.

3.3.2 Social impacts

The key community impacts will be reduced social tensions among different stakeholder through equitable water distribution and reduced impacts on the environment. This will result in improved irrigator behaviour towards efficient irrigation management. The more rational, flexible and equitable distribution of water within farmers’ organisations is also expected to increase overall food production in the command area, thus increasing food security. Improved management and supply and demand coordination for surface water supplies can reduce inequity in water distribution between head- and tail-reaches of the
system, and contribute to improved social relations and reduced litigation among water users in Pakistan.

The key Australian economic benefit will be reduced third party salinity costs due to rational augmentation of surface and ground water. The policy options developed under the project could lead to a better mix of perennial and annual crops leading to optimisation of economic returns from limited surface and ground water supplies, while improving the environmental quality.

### 3.3.3 Environmental impacts

The environmental impacts of this research in both countries are anticipated to be reduced incidence of land and water salinisation and the potential to rehabilitate salinity-affected areas in the longer term, as well improved equity in terms access to water particularly in Pakistan. The more efficient use of water and land resources is also likely to reduce adverse downstream impacts due to enhanced quality of return flows. Conjunctive use of surface and canal water can minimise the adverse impacts on the environment due to escalating ground water demand in Pakistan.

### 3.4 Communication and dissemination activities

The project activities and outcomes are being communicated widely among the stakeholders through FOs field days and demonstration and training components of the project, as well as workshops, conferences, briefing, technical notes, public seminars. The findings of the project annual workshop in January 2010 were broadly communicated to national newspapers including major English and Urdu. For instance, PC team members were interviewed by radio and TV channels during their visit to CSU in May 2010. During this visit, the PC team members also gave seminar on:

Prof Dr Niaz Ahmad Rai, Director, Water Management Research Centre, University of Agriculture, Faisalabad, Pakistan on "Water saving techniques in irrigated agriculture".

These presentations were also attended by the members of a visiting delegation from Hohai University, Hubei University and Yangtze River Commission from China whereby they also held discussions on areas of mutual scientific interest and agreed on tri-angular working arrangements to be led by CSU team. These delegates also visited ACIAR in May 2010 and gave presentation and explored opportunities for project development in-line with the funding priorities of the ACIAR/AusAID and Australian Government. Concept notes will be jointly drafted by the PC team, China delegates and shared with CSU team for dialogue and submission to ACIAR for potential funding.
Annual report: Optimising Canal and Groundwater Management to Assist Water User Associations in Maximizing Crop Production and Managing Salinisation in Australia and Pakistan
Efficient use of water, land to enhance farm yield

By Our Staff Correspondent

FAISALABAD, Jan 11: Agriculture scientists stressed the need for enhancement of production by utilising all the given water and land resources to meet the food requirement of Pakistan’s growing population. Addressing the inaugural session of the one-day workshop on “ACIAR Project Activities 2009” here on Monday, University of Agriculture Faisalabad (UAF) Vice-chancellor Dr Ignatius Ahmad said Faisalabad was gradually transformed into a green area with the help of world’s largest canal system introduced by the then British rulers.

The workshop was organised in collaboration with the International Centre for Water for Food Security, Charles Sturt University Australia and PDA, Pakistan, at the STC Hall of the UAF.

The VC said the variety was striving hard to transform the existing land and irrigation resources into an efficient and economic system of inputs so as to reap the long-term benefits of sustainable development.

Dr Ahmad highlighted the significance of water use and stressed the need for using all agricultural inputs effectively to enhance the crops’ production.

He said the HEC was pursuing the idea of setting up specialised research groups in all varieties which would deal with their respective domains.

Earlier, Dr Mohsin Hafeez of the Charles Sturt University said the scientists should take constructive steps to double Pakistan’s agricultural production as the country was facing multifarious challenges right from farm to distributions, market and yield handling.

He said in Australia, water scarcity had reached up to 10 per cent in 2007-08 and the people were very much aware of the threat.

Dr Rai Niaz Ahmad of UAF’s Water Management Research Centre said that other parts of the world, Pakistan too was facing irrigation water shortage.

He said pressure was increasing on local groundwater which was not sustainable and might affect productivity of the land and the crop.

“In Pakistan, groundwater resources vary from fresh to poor and when distributed the head has mostly fresh or better water quality than the tail,” he added.

He said the distribution of the surface water was also different for various water users.
4 Training activities

Key training activities conducted by the CSU team under this project include:

1. Training to PC team on the use of GPS for the collection of geo-referenced data and the ground truthing of Remote Sensing and satellite data

2. Training on the use of Electrical Conductivity (EC) meters for collecting data on water quality.

3. The development of questionnaire for the collection of socioeconomic data, and training to PC staff in Pakistan on data collection, collation, and analysis. The CSU team will also lead the data collection campaign in July 2010 to provide on-job training to the PC field team and new team members.

4. The PC team was provided hands-on training on socioeconomic data modules, data entry, pre-processing, and economic analysis using Excel and SPSS softwares. Special training was provided to 8 team members (including 6 female members to ensure gender inclusion) on panel database development, retrieval, security and sharing among the team members. This training was widely appreciated by the Vice Chancellor and PC team leaders. Future trainings on socioeconomic component are planned for PC team during 2010, with emphasis on training of the female team members, for current and prospective PhD students at UAF and PIDA as requested by PC.

5. Training on remote sensing for modelling of actual ET in data sparse environments to PC team. Future trainings on this component are planned during.

6. Training on the protocol and format for database development and sharing the project data among the team members in PC and Australia.

As noted earlier, the two visiting parties from China (5 members) and Pakistan (6 members) held discussions on areas of mutual scientific interest and agreed on tri-angular working arrangements, lead by CSU during May 2010. This offers significant opportunities for future cooperation and collaborative Projects.
5 Intellectual property

There are no intellectual property and other regulatory compliance concerns in the project, at this stage. Information generated, technologies tested and model developed will be handed over to the respective stakeholders to facilitate their implementation and adoption. All intellectual property issues will be subject to the standard clause under the Australian state and territory regulations.
6 Variations to future activities

There are no major variations to year 2 activities at this stage. However, there are some minor variations to personnel's time allocation given their skill-set and the future needs of the project from Australian and PC. There are few changes in the available scientific team of CSU and more detail is given in the next section.
### 7 Variations to personnel

The following personnel are available for ACIAR Project.

<table>
<thead>
<tr>
<th>Contract Named Person</th>
<th>Role</th>
<th>% of Time</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/Prof. Mohsin Hafeez</td>
<td>Spatial hydrology, water management, Project Leader</td>
<td>20%</td>
<td>CSU</td>
</tr>
<tr>
<td>Dr. Munir Hanjra</td>
<td>Economics and water policy, equity and welfare analysis and participatory irrigation management, stakeholder engagement</td>
<td>20%</td>
<td>CSU</td>
</tr>
<tr>
<td>Dr. Yann Chemin</td>
<td>Remote sensing specialist for ET and soil moisture estimation</td>
<td>20%</td>
<td>CSU</td>
</tr>
<tr>
<td>Dr. Nadeem Asghar</td>
<td>Hydrology, water management</td>
<td>10%</td>
<td>CSU</td>
</tr>
<tr>
<td>Dr. Richard Claus</td>
<td>Economics, economic analysis and resource use optimisation</td>
<td>20%</td>
<td>CSU</td>
</tr>
<tr>
<td>Mr. Kaleem Ullah</td>
<td>Hydrology, system dynamics modelling, system optimisation</td>
<td>30%</td>
<td>CSU</td>
</tr>
<tr>
<td>Mr. Umair Rabbani</td>
<td>Remote Sensing and GIS, and spatial Hydrology</td>
<td>20%</td>
<td>CSU</td>
</tr>
<tr>
<td>Professor John Blackwell</td>
<td>Water management</td>
<td>10%</td>
<td>CSU</td>
</tr>
<tr>
<td>Mr. Habib Ullah Bodla</td>
<td>Canal operations, Head PMIU, Project Coordinator</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Dr. Muhammad Javaid</td>
<td>Hydrology, Groundwater data provisions and conjunctive management scenarios</td>
<td>50%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Dr. Muhammad Riaz</td>
<td>Irrigation modeller, Decision support system</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Mr. Azhar Javaid</td>
<td>Salinity and groundwater management, data provisions and modelling</td>
<td>50%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Mr. Basharat Ullah</td>
<td>Agronomy, crop database development</td>
<td>50%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Name</td>
<td>Role</td>
<td>Percentage</td>
<td>Department</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Mr. Abdul Shakoor</td>
<td>IT and irrigation database development</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Mr. Tauseef Ahmed</td>
<td>IT Professional and Developer, Database development</td>
<td>20%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Mr. Ali Zeb</td>
<td>Irrigation Engineer</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Mr. Usman Tehsin Shah</td>
<td>Assistant Director Monitoring, Discharge observation</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>M. Khurram Ilyas</td>
<td>Software developer, database development</td>
<td>30%</td>
<td>PIDA</td>
</tr>
<tr>
<td>Prof Dr. Rai Niaz Ahmad</td>
<td>Project Co-Coordinator</td>
<td>30%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Azeem Ahmed Khan</td>
<td>Water Management</td>
<td>20%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Amir Saeed</td>
<td>Agricultural Economist, Farmer interviews</td>
<td>15%</td>
<td>UAF</td>
</tr>
<tr>
<td>M. Waseem Ahmad</td>
<td>Interviews with scientists and regulation agencies staff to identify issues</td>
<td>15%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Umer Draz Khan</td>
<td>Farmer interviews to identify their concerns and aspirations about the project</td>
<td>50%</td>
<td>UAF</td>
</tr>
<tr>
<td>Dr. Sher Muhammad</td>
<td>Agricultural extension, technology transfer and demonstration to farmers</td>
<td>25%</td>
<td>UAF</td>
</tr>
<tr>
<td>Dr. Muhammad Arshad</td>
<td>Irrigation and groundwater database development and scenarios development</td>
<td>40%</td>
<td>UAF</td>
</tr>
<tr>
<td>Dr Abdul Nasir Awan</td>
<td>Spatial hydrology, GIS, database development, water accounting</td>
<td>50%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Ahmad Waqas</td>
<td>Technical support for water accounting at farm, distributary and minor</td>
<td>50%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Aamir Khan</td>
<td>Sociology, Farmer interviews</td>
<td>50%</td>
<td>UAF</td>
</tr>
<tr>
<td>Mr. Arif Manzoor Khan</td>
<td>Agriculture, crop varieties and crop water demand</td>
<td>50%</td>
<td>UAF</td>
</tr>
</tbody>
</table>
8 Problems and opportunities

No major problems are identified at this stage.

New opportunities include:

1. New training opportunities for PC staff and students to use Remote Sensing tools for modelling the conjunctive use of surface and groundwater, and its coupling with socioeconomic data and analytical tools. Such training facilities are currently not available in Pakistan.

2. Training of UAF staff in template development for data collation, and use of statistical and econometric packages for data analysis.

3. Training of PC team in writing and publishing papers in Australian and other international journals.

4. Training of PC team in writing a Book for joint publication, with Australian team members as Editors and lead authors.

5. Two of the potential PhD students from PC are girls. Their successful training will contribute to gender empowerment and gender equity in PC.

6. Training of two post-doc female members from PC at CSU Australia that will contribute to gender empowerment and gender equity in PC through capacity development training-the-trainer (both are academic staff in PC).

As noted earlier, during May 2010 the two visiting delegations from China (5 members including one female member) and Pakistan (6 members including 2 female members) held discussions with ACIAR and other partners in Australia on areas of mutual scientific interest and agreed on tri-angular working arrangements between PC, China and Australia, lead by CSU. This offers significant opportunities for future cooperation and collaborative Projects in PC and China.
9 Budget

There is no significant variation from the approved budget during the reporting period. A summary of expenditure is given below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milestone 1-2: Payment to Pakistan-Punjab Irrigation and Drainage Authority as per Contract</td>
<td>$42,422.00</td>
</tr>
<tr>
<td>Milestone 1-2: Payment to Pakistan-University of Agriculture, Faisalabad as per Contract</td>
<td>$43,820.00</td>
</tr>
<tr>
<td>CSU Expenses including PC members travel</td>
<td>$189,152.00</td>
</tr>
</tbody>
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