CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

SCIENCE COUNCIL

Report of the Fifth External Programme Review of the International Crops Research Institute for the Semi-arid Tropics (ICRISAT)

SCIENCE COUNCIL SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

January 2004

Consultative Group on International Agricultural Research (CGIAR)

CGIAR Annual General Meeting, 2003 (AGM03)

External Programme Review of ICRISAT[1]

The CGIAR Chairman introduced the item, and briefly explained the separate but linked external programme and management review process.

The EPR report findings were presented by Panel Chair Paul Vlek. He commended the expertise of both panels. The EPR Panel took a retrospective and prospective view and focused on strategic and programmatic matters, mission relevance and quality of science, and accomplishments and impact. It noted the Centre's excellent science output, but also that it is losing its competitive advantage in Asia. Its international public goods (IPGs) impact/delivery in Africa is not clear and the Panel felt that ICRISAT had not followed the recommendation of the fourth EPMR to focus on and contribute to Africa. The Centre does not have a solid footing in Africa, and is even losing ground, i.e. it lacks a critical mass in Africa. Management problems that were apparent include excessive changes in management, unstable organization, shifting vision and mission, dwindling support, and lack/weak fundraising strategy. In addition, it's new vision/mission is rather broad. Global themes will, however, help integration.

He gave an overview of the recommendations in the report, and noted that this is a defining moment for ICRISAT. Many activities need to be phased out in Asia and moved to Africa. It should rethink the Virtua l University, which does not appear to have any comparative advantage, lacks critical mass and is not delivering IPGs. Strategic upstream activities should be maintained in Asia, but its main activities and HQ should be moved to Africa. Most importantly, it needs a strategy for SSA.

He concluded by thanking the ICRISAT staff, field teams and the CGIAR for the opportunity to serve the System.

[1] Extract of Summary of Proceedings and Decisions, CGIAR Annual General Meeting, October 28-31, 2003, Nairobi, Kenya.

Consultative Group on International Agricultural Research (CGIAR)

Interim SCIENCE COUNCIL
Emil Q. Javier, Chair

9 September 2003

Dear Ian,

It is my pleasure to submit to you the Report of the Fifth External Programme Review of ICRISAT, commissioned by the interim Science Council. The Panel was chaired by Dr Paul Vlek of the Netherlands.

The Review Report and ICRISAT's Written Response to it were considered by the interim Science Council at its 85th meeting held on 30 and 31 August 2003 at the University of California, Berkeley. The Panel Chair presented the Report and ICRISAT was represented by the Board Chair, Dr Uzo Mokwunye and the Director General, Dr William Dar.

In addition to the Panel's Report, there are two attachments to this letter, the first containing the commentary of the interim Science Council, which summarizes the Council's views on both the Panel's Report and the Written Response from ICRISAT; and the second is ICRISAT's Response to the Review Report.

The interim Science Council generally endorsed all the 9 recommendations, and noted the very positive response from ICRISAT. The Institute has undergone a difficult period of management changes and reduced overall funding as well as reduced unrestricted funding. Despite these difficulties, there has been laudable improvement in key strategic areas in science, governance and management. Given the compelling justification for a stronger and continued international role for raising productivity, alleviating poverty and sustaining the environment in the semi-arid tropics, the Institute continues to deserve donor support.

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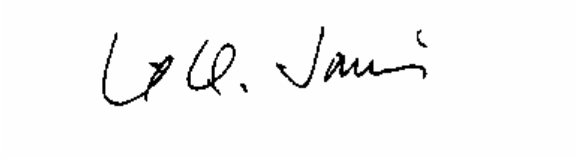
The interim Science Council agrees with the Panel that ICRISAT has reached a defining moment in its evolution. It must now establish a new long-term vision and structural strategy that would: (i) consolidate its gains in Asia as it shifts its Asia work to strategically supporting the rapidly growing strength of NARS in Asia; and (ii) strengthen and redirect its focus on the challenges of Sub-Saharan Africa, necessitating a paradigm shift in research strategy to take into account the heterogeneity of agricultural environments, the relatively weak national scientific capacity in research and extension, the relatively undeveloped private sector in agricultural and related rural industries, and the unfavourable policy environment.

ICRISAT has expressed it commitment to seize the opportunity for implementing the proposed fundamental changes but it needs donor support in both “spirit and matter”. Donor support for meeting the one-time relocation cost would be essential, as would high level CGIAR involvement in discussions with India on the plan to shift the Headquarters to Sub-Saharan Africa. Given the need to maintain the existing strong and valuable relationship with India for the CGIAR international effort, the CGIAR leadership should work with ICRISAT to facilitate the envisaged discussions with India government.

We trust that the Group will find the Panel’s Report and attached communication helpful in reflecting on the challenges facing ICRISAT and the CGIAR in the future.

Yours sincerely,



Emil Q. Javier
iSC Chair

iSC Commentary on the
Fifth External Programme Review of ICRISAT

The report of the Fifth External Programme Review (EPR) of ICRISAT was discussed at iSC/TAC 85, University of California, Berkeley, in the presence of the Panel Chair, Dr Paul Vlek, the Chair of ICRISAT's Board of Trustees, Dr Uzo Mokwunye, ICRISAT DG, Dr William Dar, and ICRISAT DDG Research, Dr Dyno Keatinge. The interim Science Council (iSC) expresses its appreciation to Dr Paul Vlek and the members of the Panel for an analytical and forward-looking report that confirms ICRISAT's areas of excellence and the praiseworthy changes during the review period, and offers recommendations for a structural transformation of the Institute in the coming years.

The iSC accepted the EPR Panel Report and generally endorsed all the 9 recommendations. The iSC is pleased to note the very positive response from the ICRISAT Board and management. The iSC provides the following commentary based on the discussions at the iSC/TAC 85 to supplement the work of the Panel.

Response to 4th EPMR

The 4th EPMR contained 10 recommendations. Overall the Panel considered the action taken in the research domain over the past 6 years in response to the 4th EPMR to be of mixed quality. This is believed to be due partly to disagreements that existed within and between management and the Board. The iSC is pleased to note that the situation seems to have been sorted out, although the resulting turbulence and instability have caused a delay in the implementation of some of the recommendations. TAC in its commentary on the 4th EPMR fully supported the recommendations and the Panel's preference for the 'new ICRISAT' with a two-pronged strategy, consistent with the contrasting needs in Asia and Africa. TAC stated, "There seem to be no reason, in principle, why the Director General of this Centre should not be based in Africa. This point is raised to illustrate how the thinking at ICRISAT should change and broaden."

The Report of the 5th EPR contains one recommendation (Recommendation 9) that deals with the fundamental question of the future structure and strategy of ICRISAT. The iSC considers that Recommendation 9 deals with unfinished business initiated in response to the 4th EPMR, and is of the opinion that the need to implement Recommendation 9 to create a new ICRISAT for the 21st Century is now urgent.

Genetic Resources and Crop Improvement

The iSC commends ICRISAT for its achievements in setting up a biotechnology and transformation programme, bringing to bear "new science and tools" for conservation and improvement of its mandate crops. The Panel has recommended (Recommendation 1), and the iSC agrees, that the Institute together with the other CGIAR Centres and relevant partners, address the pressing issues on intellectual property, biosafety and public acceptance of transgenic crops. Additionally, the Panel has recommended (Recommendation 5) that ICRISAT address the anticipated problems related to delivery and marketing of transgenic material it will produce. The iSC considers these issues to be pervasive, requiring proactive attention. It is of great importance that the resource and infrastructure implications of the

issues related to biosafety and delivery of transgenic material are understood clearly by ICRISAT and its partners. It is almost certain that the cost of biosafety research will not be cheap and nor will be the institutional cost of handling and transferring finished transgenic material to beneficiaries.

The iSC commends ICRISAT for its impressive achievements in plant breeding in its mandate crops. However, the iSC fully shares the Panel's concerns regarding the weakening of its breeding programmes in Africa, and the less than optimum integration between genetic enhancement work located in GT1 (Harnessing Biotechnology for the Poor) and crop improvement work located in GT2 (Crop Improvement, Management and Utilization for Food Security and Health). The iSC is in agreement with Recommendation 2 for ICRISAT to rapidly rebuild its breeding programmes in Africa, and to re-engineer its genetic enhancement and crop improvement activities to serve the differential needs of Asia and Africa for international public goods (IPGs).

The iSC is pleased to learn that the process of integrating activities in GT1 and GT2 is already underway, and that ICRISAT intends to create an interdisciplinary partnership for genetic resources and enhancement with NARS and the private sector in the Asia region. However, the iSC remains concerned at the fact that in recent years ICRISAT has not been able to mobilize adequate stable support for its crop improvements activities in Africa that has consequently suffered from high turn over of senior staff and discontinuities. The rebuilding of ICRISAT's breeding programmes in Africa must remain a top priority, requiring the development of staff recruitment and deployment strategies that would minimize transfers and provide sufficient overlapping of personnel for effective continuity in activities with long time-frames.

Social Sciences

The iSC notes that ICRISAT agreed with Recommendation 7 to establish a critical mass of social scientists in all regions to create an appropriate balance in activities managed in GT6 (SAT Futures and Development Pathways) and social sciences research in the other Global Themes. The iSC supports ICRISAT's intention to maintain distinctiveness for social science activities at ICRISAT under the GT6 programme, while contributing to the interdisciplinary nature of the other programmes. ICRISAT is in the process of strengthening its critical mass of social scientists, and the iSC agrees that this could be done innovatively in part by hiring young professionals.

Virtual University

The Panel has seriously questioned ICRISAT's comparative advantage in serving as a key proponent in launching the Virtual University for the SAT, and recommended (Recommendation 8) that ICRISAT should rationalize its role, scope and objectives in the University initiative. Secondly, the Panel has pointed out the confusion inherent in the use of the term University which conventionally is applied to academic institutions offering degrees at the tertiary level whereas in reality the main activity of the Virtual University is to deliver information to producers and intermediate actors. The iSC therefore agrees with the concerns highlighted by the Panel and recommends that ICRISAT take the necessary steps to define clearly its ultimate objectives and role in the enterprise before further major investments of funds, personnel and management attention are directed to it.

Other Specific Programme Recommendations

The Panel has made other specific programme recommendations, namely the need: to phase out GT3 (Water, Soil and Agrobiodiversity Management) in Asia where it no longer has a comparative advantage (Recommendation 3); to prioritize and consolidate IPM and IDM activities in GT3 (Recommendation 4); to rationalize the role, scope and objectives in terms of its comparative advantage in conducting research in generating IPGs in GT4 (Sustainable Seed Supply Systems for Productivity) (Recommendation 5); and to merge GT5 (Enhancing Crop-Livestock Productivity and Systems Diversification) with GT3 (Recommendation 6). ICRISAT has accepted all these recommendations, and the iSC looks forward to their implementation.

Future of ICRISAT

The iSC strongly supports Recommendation 9 on the transfer of ICRISAT Headquarters and all programmes to Africa with the exception of its strategic plant genetic resources and enhancement programme. To implement Recommendation 9, the iSC supports the proposal on the Centre's response of establishing a Task Force to design and plan the transfer. The iSC believes that a prerequisite for successful implementation will be the availability of sufficient funding from donors to cover one-time transfer costs. It will be important to preserve the excellent relations between ICRISAT and India by involving the CGIAR leadership at the earliest opportunity in the discussion with the host government of the new arrangement for the global branch of ICRISAT that will remain in India to address the SAT needs, including those of Asia, for which there is continued support. The iSC also believes that this is an opportunity for the CGIAR to take a broad view of its operations in Sub-Saharan Africa and, as ICRISAT plans to move, to assess the needs for streamlining and coordination of CGIAR Centres operations in the region.

The iSC recommends that the Task Force that will be appointed by ICRISAT Board should consider all tactical issues related to the transfer as well as the needs for changing scientific paradigms as some programmes move from Asia to Africa. The iSC also suggests that the Task Force works closely with the Science Council (SC) while it develops its plans, perhaps by including a SC member as part of the Task Force.

Organization and Management

The iSC is pleased that the Board has become more effective in working with management and staff in turning the Centre around from where it was at the time of the last EPMR and the first few years thereafter. The current Director General and management have also contributed in creating an enabling environment for research. The resulting effectiveness and stability has had a positive effect on the Institute's relationship with the host government and on staff morale. The iSC commends this laudable transformation of ICRISAT leading to improvement in key strategic areas. The iSC considers that this changed leadership and political situation should be taken full advantage of by the Centre in pushing ahead more earnestly with unfinished business, particularly the need to structurally transform the Centre as elaborated above.

Conclusion

ICRISAT has undergone a difficult period of management changes and reduced overall funding as well as reduced unrestricted funding. Despite these difficulties, ICRISAT has managed to produce science of high quality and achieve impressive impact in Asia as witnessed by the Institute gaining two King Baudouin Awards during the review period. There has also been laudable improvement in atmosphere and relations with new management and Board. Given the compelling justification for a stronger and continued international role for ICRISAT in the SAT in those circumstances where it has a comparative advantage, the Institute continues to deserve donor support.

The iSC agrees with the Panel that ICRISAT has reached a defining moment in its evolution. It must now establish a new long-term vision and structural strategy that would: (i) consolidate its gains in Asia as it shifts its Asia work to strategically supporting the rapidly growing strength of NARS in Asia; and (ii) strengthen and redirect its focus on the challenges of Sub-Saharan Africa, necessitating a paradigm shift in research strategy to take into account the heterogeneity of agricultural environments, the relatively weak national scientific capacity in research and extension, relatively undeveloped private sector in agricultural and related rural industries, and the unfavourable policy environment.

ICRISAT has expressed it commitment to seize the opportunity for implementing the proposed fundamental changes but it needs donor support in both “spirit and matter”. Donor support for meeting the one-time relocation cost would be essential, as would high level CGIAR involvement in discussions with India on the plan to shift the Headquarters to Sub-Saharan Africa. Given the need to maintain the existing strong and valuable relationship with India for the CGIAR international effort, the CGIAR leadership should work with ICRISAT to facilitate the envisaged discussions with India government.

August 6, 2003

Dr Emil Javier
Chair, Interim Science Council
Consultative Group on International Agricultural Research
Institute of Plant Breeding
University of the Philippines at Los Banos
4031 College,
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Dear Emil,

On behalf of ICRISAT, I would like to submit to you in the attached file our responses to the recommendations made by the recent EPR Panel under the chairmanship of Dr P. Vlek.

We would like to record our acknowledgement of the fair treatment and transparent conduct of the review that we experienced with the Panel. In general, we are most satisfied with the outcome and we believe that this review will be a good guide for ICRISAT in the coming 5 years.

Best regards.

Yours sincerely,

William D Dar
Director General
ICRISAT

CC: Shellemiah O. Keya, Paul Vlek, Francisco Reifschneider, Amir Kassam
Uzo Mokwunye

August 6, 2003

ICRISAT 2003 EPR RECOMMENDATIONS AND RESPONSES

1. The Panel recommends that ICRISAT continue to undertake strategic research on genomics and transgenic product development for SAT crops; and together with the other CGIAR Centres and relevant partners, address the pressing issues on intellectual property, biosafety and public acceptance of transgenic crops.

ICRISAT accepts the recommendation, and will continue to ever more vigorously undertake strategic research on genomics and transgenic product development for SAT crops. At the same time, we will expand our research in the biosafety aspects of transgenic crops, and proactively address issues related to public acceptance and IPR of biotechnology products.

2. The Panel strongly recommends that ICRISAT should maximize the synergy possible when GT 1 and GT 2 plus their partners work closely together to generate IPGs for the SAT. ICRISAT should rapidly re-build and re-engineer its crop improvement programme and further enhance the evolution of the two pronged breeding strategy for Asia and Africa.

We accept the recommendation. The process of integrating activities in GT 1 (Biotechnology) and GT 2 (Crop improvement, Management and Utilization) is already well underway. However, we accept the challenge to create a truly comprehensive genetic resources and enhancement paradigm through systemic multidisciplinary partnerships with NARS and private sector partners in the region. In this way we will fully capture the potential synergy between disciplines and sectors, and hope to serve the differential needs of Asia, Africa and the CGIAR as a whole

3. The Panel recommends that ICRISAT phases out GT3 (Water, Soil and Agrodiversity management) research in Asia where it no longer has a comparative advantage, by devolving this research to NARS. These resources should be redeployed in Africa where they should be engaged in addressing some of the major challenges in land, water and agrodiversity research facing the SAT of the continent.

We accept the recommendation and will re-deploy unrestricted funding to strengthen GT 3 activities in SAT Africa in a phased manner that will then better address the major challenges of land, water and agro-diversity research. However, given the availability of opportunities for restricted funding in the area of GT3 activities in Asia, ICRISAT will continue to pursue these simultaneously and create a self-supporting natural resource management team in Asia. In this way, GT3 scientists would continue to contribute to ICRISAT's IGNRM and new science strategies and draw lessons from long-term development programs in Asia to help translate these for impact in Africa.

4. The Panel recommends ICRISAT prioritize its activities in IPM/IDM. Potential projects should be chosen with priority being give to projects that address constraints that are important in Africa and are potentially solvable through IPM and IDM approaches.

ICRISAT agrees with the recommendation and will plan to undertake IPM/IDM research as an integral part of the IGNRM approach to meet the food security needs of smallholder farmers in SAT Africa.

5. The Panel recommends that ICRISAT rationalize the role, scope and objectives in terms of its comparative advantage in conducting research generating IPGs in GT4 (Seed systems). This includes addressing the anticipated problems related to marketing transgenic materials it will produce. The purposes and goals of GT4 will be best served if its activities are strongly anchored into appropriate global themes where interdisciplinarity can be enhanced and resources more efficiently and effectively utilized.

We agree with the recommendation that the work on seed systems should generate further IPGs. ICRISAT agrees that inter-disciplinarity needs to be enhanced and would endeavor to integrate activities, wherever needed.

6. The Panel recommends that GT5 (Enhancing crop-livestock productivity and systems diversification) should transfer assessment of feed quality to GT2 (Crop Improvement, management and utilization) and cease its other activities in Asia. The level of staffing should be increased, and strategic research in Sub-Saharan Africa expanded, particularly in landscape level research on new systems. To ensure coherence in ICRISAT's programmes this theme should be merged with GT3 (Water, soil and agro-biodiversity management).

ICRISAT agrees with recommendation and will transfer the breeding for fodder quantity and quality to GT 2. Component design of IPM/IDM system will remain in GT 2, with system testing of integrated components in GT 3 as recommended. Crop-livestock systems and systems diversification will be subsumed in to an expanded GT 3 - Land, Water and Agro-diversity Management.

7. The Panel recommends more vigorous implementation of the recommendations of the CCER of Socio-Economics and Policy Research Programme at ICRISAT, 1996-2001. More social science resources should be re-allocated from GT6 (SAT Futures and Development Pathways) to the other themes under the leadership of non social scientists and the work programme of social science should be more sharply focused on strategic assessments and activities that best inform macro and longer run priority setting in ICRISAT.

We agree with the recommendation to more vigorously implement the CCER recommendations for socio-economics and policy research. We are in the process of establishing a critical mass of social scientists in all regions and global themes to undertake strategic research that will generate IPGs, as well as viable partnerships and policy recommendations of strategic importance to SAT agriculture. However, we believe that it is necessary to have some direct visibility for social science activities at ICRISAT. Thus we would seek to create an appropriate balance between those activities managed under GT6 and the remaining social science activities managed in other global themes under the leadership of non-social scientists.

8. The Panel recommends that ICRISAT should rationalize the role, scope and objectives of the Institute in the distance learning for farmers initiative called the Virtual University for the SAT and provide management with clear guidance on where the limits of ICRISAT's interest lie consistent with its comparative advantage in IPG research. Further, the term University should be replaced with a more appropriate term such as "Virtual Learning Centre for the SAT".

The recommendation is accepted in spirit. ICRISAT will further delineate the roles of ICRISAT and other members of the VUSAT coalition. Nevertheless, since VUSAT has been widely accepted and has captured the support of all partners, we shall work with the members of the coalition and the Board to find a suitable way to implement the recommendation**.**

9. The Panel recommends that ICRISAT should rapidly restructure its programmes and transfer its headquarters, and all programmes except its strategic plant genetic resources enhancement programme to sub-Saharan Africa.

ICRISAT accepts the spirit of the recommendation. It accepts the challenge to find a win-win scenario to enhance its impact in Africa and affirms its commitment to continue shifting core resources to address the needs of the farmers of sub-Saharan Africa as a high priority whilst yet dynamically responding to the ever-changing needs and profile of its stakeholders in Asia. ICRISAT will immediately establish a task force to comprehensively study the programmatic issues, costs (both human and financial), host country agreements, and donor support for various potential change scenarios. However, ICRISAT does not accept the view that the ICRISAT-Asia team should be devoid of INRM or social scientists as we see these as a necessary compliment to supporting well-targeted, upstream genetic enhancement activities. We would propose therefore to retain at least a minimum presence of such disciplines in Asia supported by special project funds.

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Dr Emil Javier
Chair, Interim Science Council
Consultative Group on International Agricultural Research
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University of the Philippines at Los Banos
4031 College, Laguna
PHILIPPINES

25 June 2003

Dear Dr Javier,

I am pleased to transmit the Report of the Panel that conducted the Fifth External Programme Review (EPR) of ICRISAT.

The Panel has highlighted the remarkable scientific accomplishments of ICRISAT. It believes that the management upheaval and the accompanying loss of morale and confidence that characterized much of the second half of the 1990s is now generally water under the bridge. Under the stable leadership of the current Director General and the Board, there are strong signs that ICRISAT is gaining strength. The Institute has begun to chart a new course of action for the medium and longer term based on a systematic bottom up process of setting its regional and international priorities and strategies. The Panel stresses the need for completing the strategic planning process and defining the right balance between Africa and Asia in ICRISAT's role, objectives and institutional presence, which hopefully will take the recommendations of the Panel on board.

The Review has come at a defining moment for ICRISAT. After 30 years of committed research and laudable impact, the Institute must fundamentally reconstitute itself for the 21st Century taking into account the contrasting needs, challenges and opportunities in its mandate SAT zones in Asia and Africa. This reconstituted ICRISAT would have its HQ in Africa and comprise: (1) a strong integrated germplasm enhancement and natural resource management programme focussed on and coordinated from Africa; and (2) an upstream cutting edge genetic resources and enhancement programme coordinated from a part of the campus at Patancheru where ICRISAT's unique international germplasm collections are located.

The Panel recognizes the challenges inherent in the course it has recommended for ICRISAT. The institutional and programmatic restructuring called for are fundamental and can only be carried out successfully during this transition period with the special support of the CGIAR.

The Panel received help and support from several sources. We are grateful to ICRISAT Board, management and staff for providing every assistance to carry out our task smoothly and efficiently. Consultations with the Board, management and staff at every level, both at the HQ and in locations in Africa were frank, open and cordial. The same was true of our interactions with ICRISAT's partners in Asia and Africa who shared their opinions and perceptions of ICRISAT and its activities, including the future role of ICRISAT.

I would like to thank you for assembling a capable and experienced team for the challenging task of conducting this Review. The Panel has worked exceptionally well together throughout.

I want to add my own special thanks to the members of the Review Panel for their effort to make this report accurate and useful, and for being sports and available at any hour of the day. The Resource Person assigned to the Panel, Amir Kassam, from the interim Science Council Secretariat, deserves our grateful thanks for his competence, sound advice and good humour.

We are confident that the ICRISAT Board, management and staff are capable, in collaboration with their partners, to take and implement the strategic decisions which now must be made if ICRISAT is to serve the poor people of the SAT regions. We strongly recommend that the iSC and the CGIAR extend them their full support at this critical moment in ICRISAT's history. We hope that this Review Report will assist the Institute's development in the years to come.

In closing, all the Panel members join me in expressing appreciation for the opportunity to serve the CGIAR System as a member of this Review Panel.

Yours sincerely,

Paul L.G. Vlek
Chair

SDR/iSC:IAR/03/11

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

Interim SCIENCE COUNCIL

Report of the

Fifth External Programme Review

of the

International Crops Research Institute for the Semi-Arid Tropics

(ICRISAT)

Review Panel: Paul L.G. Vlek (Chair)
Anthony E. Hall
Desiree M. Hautea
Dunstan Spencer

Amir Kassam (iSC Secretariat)

Interim SCIENCE COUNCIL SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

June 2003

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FOREWORD

This is the Report of the Fifth External Programme Review (EPR) Panel appointed to evaluate the programme and programme management and oversight of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The membership of the Panel and their backgrounds are given in Appendix I.

Before appointing the full Panel, the Panel Chair was briefed by the interim Science Council (iSC) Chair, Emil Javier, and the iSC Secretariat. The briefing included a discussion of the Terms of Reference for this EPR and the revised Guidelines for the review process (Appendix II) as well as issues which the iSC considered important. In conducting the Review, the Panel was requested by the iSC to interpret the Terms of Reference and the Guidelines in the light of the new CGIAR focus on science relevance and quality, the new monitoring and evaluation approach proposed by the iSC, and the need to streamline and reduce the cost of the review process.

As a result, the Panel composition and size were specifically defined for the purpose of this EPR. This was followed by a design visit of five days to ICRISAT HQ in March 2003, which coincided with ICRISAT Board meeting, when the Panel identified the key issues facing the Institute, and decided not to add to the Panel composition. Although, there was originally a provision for an additional Panel member and two consultants, none were appointed as result of the appraisal during the design visit. Further, field visits were kept to a minimum necessary and undertaken by two Panel members visiting the ICRISAT team in West Africa, and one Panel member and the iSC Secretariat resource person visiting the ICRISAT teams in Southern and Eastern Africa. A new feature introduced in this review was the virtual mode of working, curtailing the length of the main phase visit by half. All of the above measures were introduced to reduce costs and minimize disruption of work at ICRISAT while maintaining the credibility and objectivity of the evaluation.

During the design visit, the Panel received briefings from and interacted with senior management and staff. The Panel attended the meetings of the Board and of the Programme Committee and the Technology Exchange Committee of the Board, and had a special session with the Board on issues and challenges facing ICRISAT. Subsequently, the Panel worked in a virtual mode from home bases until the main phase visit to ICRISAT HQ from 16 to 25 June 2003. During the main phase visit, the Panel worked electronically, thus minimizing the need to produce hard copies. The Panel completed its report by the end of the main phase visit, and presented the main findings and recommendations to the management and staff before departing.

The information on which the Panel based its decisions regarding the key concerns and issues, and its assessments and conclusions were gathered in a number of ways. These included: visiting the Institute's HQ for the design visit and main phase visit and interacting with the Board, management and staff; visiting ICRISAT's regional teams in West Africa, Eastern Africa and Southern Africa; meeting and interviewing ICRISAT's collaborators in the North and the South, including half a day roundtable meeting with a range of national collaborators in India; identifying important issues and obtaining information through a survey letter to all CGIAR institutions collaborating with ICRISAT, and to all CGIAR members and regional representatives. Further, both the iSC and the ICRISAT Board and

management raised issues that they considered important for the review. The Panel itinerary is given in Appendix III.

The Panel had access to documents and data made available by ICRISAT in advance, during the virtual phase and during the main phase visit. The Panel also asked ICRISAT to prepare specific documents in advance of the design visit, including a document on the management of relevance and quality of science at ICRISAT.

The iSC Secretariat was responsible for execution of the review under the oversight of the iSC. The Secretariat provided: documentation covering different aspects of the CGIAR System; a Panel Secretary/Resource Person to the Panel; logistical and administrative support; and secretarial assistance. A list of documents given to the Panel is shown in Appendix IV. One of the documents provided by ICRISAT was the response of the Institute to the recommendations of the Fourth External Review, which is reproduced together with the Panel's comments in Appendix V.

SUMMARY AND RECOMMENDATIONS

ICRISAT Today

The Panel believes that there still are substantial opportunities for developing improved varieties of ICRISAT-mandate crops and compatible agricultural systems that can contribute to improving the living conditions of poor people in the SAT by increasing the effectiveness of crop and livestock production. Other research efforts are required to ensure that the products of crop improvement and farming systems research also achieve desired impact socially, economically and environmentally. Given growing problems of natural resource degradation in the SAT, there is a need for international research and national capacity enhancement in natural resource management, socioeconomics and impact quantification and assessment. International research and national capacity enhancement can contribute to the development of improved systems for managing agricultural and natural resources of the SAT in countries where national agricultural research systems are weak, such as many countries in sub-Saharan Africa, but less so in countries in South Asia that have stronger agricultural research systems.

Scientific and technical advances are occurring with the potential to substantially contribute to the alleviation of poverty, hunger and malnutrition. These advances provide additional compelling justification for a continued and stronger international role for ICRISAT in the SAT for those circumstances where it has a comparative advantage in research over other organizations.

ICRISAT has gone through some drastic changes during the review period partly in response to the 4th EPMR and partly due to unexpected changes in leadership. In response to a recent new vision and strategy, ICRISAT's research now is organized into six global research themes. In Africa, there are three regional teams – West and Central, Southern, and Eastern, each with a Regional Representative. The Panel is of the opinion that the restructuring and the thematic reformatting of research activities have been well-intended. However, because ICRISAT has not completed its strategic planning exercise, the Institute has not yet fully identified its regional and global priorities in response to the geographically differentiated needs, challenges and opportunities for IPG research across the SAT. Resolution of these issues is central to defining an effective balance in the type and size of research efforts in Asia compared with Africa.

In response to the 4th EPMR, ICRISAT adopted a new strategic approach in germplasm research using all necessary disciplines to exploit more scientifically, systematically and fully the genetic endowment represented in the genebank. At Patancheru, GT1 (Harnessing Biotechnology for the Poor) has established a strong biotechnology programme, which has facilitated molecular evaluation of accessions and the definition of core collections by the Genetic Resources Unit.

The Panel applauds the demonstrated impact of ICRISAT's gene products in Asia and Africa during the review period. The quality of ICRISATs research on genetic resources and plant breeding is judged as being very high. The Panel also judges the quality of ICRISAT's cultivars as being very high. In recent years, several scientists working in the pearl millet, groundnut, sorghum, pigeonpea and chickpea teams have received major personal scientific awards. International public goods were generated by the biotechnology programme that have substantial value for use by public and private sector scientists and consumers. ICRISAT has

developed large and informative genetic resources and genomics databases for the mandate crops. Some 94% of the total collection (100,000 accessions) has been characterized over the last 25 years. The genomic databases are unique and valuable.

The Panels analysis of ICRISAT's published output suggests that, on average, the ICRISAT scientific community is reasonably productive in that an adequate amount of its published work has been deemed of acceptable standard by the global scientific community. Cause for concern is the fact that, while some themes and scientists have exemplary publication records, other themes and scientists have publication records that have marginal quality.

A fundamental issue affecting ICRISAT's relationships in India is the perceived degree of overlap in their programmes. The ICAR system is primarily responsible for agricultural research activities in India. Information available to the Panel suggests that relations at the scientific and administrative levels between ICRISAT and ICAR have dramatically improved since the last EPMR.

The Panel feels ICRISAT has pursued the development of appropriate partnerships with the NARS and other stakeholders.

ICRISAT has properly recognized the need for an effective vision and strategy and claims to be guided by the seven new planks of the CGIAR derived from its vision of a *food secure world for all.* The ICRISAT mission statement elaborates on the vision in that it promises to pursue the vision while insuring the protection of the environment and in partnership with many stakeholders. The promise of the mission statement is to conduct 'Science with a human face'. The Centre's mission focuses on the SAT's poor and aims to improve their livelihood.

ICRISAT's strategy is to accomplish its mission through problem-based, impact - driven regional and local projects that are subsumed in six Global Research Themes (GTs).

ICRISAT's mandated domain of operation is the tropical region with a short growing season, recurrent droughts, vulnerable soils, and limited run-off. This is, no doubt, one of the most challenging environments for the pursuit of this mission. The Panel considers it unwise to make promises that are quantitative and can or will not be met, but the absence of any concrete milestones in the Vision and Mission statements that will guide ICRISAT in the coming years, will make it more difficult to measure accomplishments of the Centre as part of strategic planning.

The Panel also notes that, although the Strategy may serve as a broad statement of principle, it lacks specificity. Particularly, it lacks the context of the major challenges that shape ICRISAT's agenda. Though the Vision statement acknowledges the differences between SA and SSA, it makes little effort to analyse these regions in order to differentiate the major challenges and resulting strategies.

The Panel believes that the comparative advantages of ICRISAT in research are in the following areas. 1) Developing, maintaining, and enhancing the use of germplasm collections of its mandate crop species. 2) Breeding enhanced germplasm and, in the short term improved varieties in some cases, and developing improved breeding methods for its mandate crop species. 3) Developing improved rainfed, cropping and integrated cropping and livestock

systems for the SAT in sub-Saharan Africa that include its mandate crop species and consideration of larger-scale aspects of NRM, such as enhanced watershed and agro-ecosystem management. 4) Analysis of institutions, policy, commercialization of seed systems, and the marketing of ICRISAT mandate crops. 5) Generating data and analysis of the evolution of rural communities in the SAT.

In other areas of research, ICRISAT needs to carefully assess its comparative advantage and should focus on strategic research possibly facilitated by strong partnerships with ARl's. ICRISAT will have difficulty in conducting and sustaining research of high quality in areas where it does not have a clear comparative advantage.

The six global research themes of ICRISAT are: GT1 Harnessing biotechnology for the poor; GT2 Crop improvement, management and utilization for food security and health; GT3 Water, soil and agro-biodiversity management for ecosystem health; GT4 Sustainable seed supply systems for productivity; GT5 Enhancing crop-livestock productivity and systems diversification; and GT6 SAT futures and development pathways. In addition, a Systemwide Programme on the Desert Margins (DMP) is managed independently.

The Panel commends ICRISAT and GT1 for its efforts to bring to bear "new science and tools" for conservation and improvement of its mandate crops, and for its ground-breaking achievements in the development of transformation systems and transgenic products in its mandate crops. The Panel assessment is that ICRISAT should continue to undertake strategic research on genomics and transgenic product development for SAT crops; and together with the CGIAR Centres and relevant partners, address the pressing issues on intellectual property, biosafety and public acceptance of transgenic crops.

The Panel commends ICRISAT and GT2 for its impressive achievements in plant breeding. In 1998, ICRISAT received the King Baudouin Award for the crop improvement research of GT2 with pigeonpea. In 2002, ICRISAT gained another King Baudouin Award for its crop improvement research on chickpea. For GT2, the Panel assessment is that ICRISAT should rapidly rebuild its plant breeding programmes in Africa, and re-engineer its genetic resources and enhancement programme in Patancheru. India, by combining staff from both GT1 and GT2, to further enhance the evolution of the two-pronged breeding strategy for Asia and Africa.

The Panel believes that ICRISAT should phase out GT3 research in Asia where it no longer has a comparative advantage, by devolving this research to NARS. These resources should be redeployed in Africa where they should be engaged in addressing some of the major challenges in land, water and agro-biodiversity research facing the SAT of that continent.

The Panel believes that GT4 should be involved in more strategic research, including analyses of anticipated problems confronting the marketing of the transgenic products ICRISAT is planning to produce.

GT5 lacks critical mass and the Panel believes that it should be restructured by transferring assessment of feed quality to GT2, ceasing activities in Asia, and integrating the remaining activities into GT3.

The Panel believes that more social science resources should be re-allocated from GT6 to the other themes operating in Africa under the leadership of non social scientists, and that

the work programme should be more sharply focused on strategic assessments and activities that best inform macro and longer-run priority setting in ICRISAT.

The Panel believes that the current Board understands its role to be one of oversight, not management as occurred in the past. The Panel considers that the current Vision and Strategy is of limited help in guiding donors or staff, and that the Board should have demanded a more elaborate and concrete Vision and Strategic Plan as a basic framework for its oversight role. Overall, the Panel considers that the Board has, in the past few years, become effective in working with management and staff.

Arrival of the current DG marked a new era in leadership at the senior management level. New vision and programme structures were defined while attention was directed to reconciling political tensions within and outside the Institute. At the same time, leadership was provided to further develop the upstream biotechnology and genetic enhancement programme. The Panel believes this achievement deserves special recognition. The recent arrival of a DDG-Research improves the prospect of scientific leadership in the Centre.

The new programme structure involving GT leaders and regional representatives has laid a foundation for a corporate leadership that is stronger, wiser and confident. This transformation must involve further delegation of authority to the scientific leadership and staff, and the strengthening of ICRISAT's presence in Africa. From a research perspective, overall, leadership at the Centre seems to have built a credible and coherent system. However, a disproportionate fraction of the power appears based in SA where finances are centrally planned and managed.

ICRISAT's unrestricted resources have seen a significant drop during the review period, and are expected to decrease further during the 2003-2005 period. This is in line with the trend in the CGIAR System where unrestricted resources decreased from 51% in 1999 to 37% in 2002, and the trend is expected to continue. Serious concerns are being registered by CBC/CDC/Centres and iSC regarding the negative impact of less than optimal level of unrestricted funding on science quality and programme effectiveness. The Panel is of the view that the management and Board should assess the operational and programmatic implications of managing the Institute in a future with less than 30% unrestricted funding.

The Panel commends ICRISAT for upgrading its communications infrastructure for connectivity, networking, knowledge exchange, library access, learning and capacity building. However the Panel seriously questions ICRISAT's comparative advantage in operating a distance learning initiative of the type and scope embodied in the Virtual University for the SAT.

ICRISAT in the Future

The Panel takes note of the rapidly changing research environment in Asia. It is also conscious of the fact that hundreds of millions of the world's poor are still living in the Asian SAT. However, this is now a region of major economic and technological advances, with the major SAT country India, having the World's second largest agricultural research community. The Panel believes that a traditional IARC, such as ICRISAT, can only make limited additional contributions to the generation of knowledge in the Asian SAT. National governments or regional bodies are able to and should be encouraged to take over this role.

The Panel therefore sees a continuing role for ICRISAT in the Asian SAT only in strategic plant genetic resources and enhancement (PGRE) for the mandate crops.

At the same time it is very clear that it is in the African SAT that the Centre still has wide scope for generating IPGs, and maintains clear comparative advantage in many areas of research. ICRISAT must find a way of accomplishing the same successes in Africa as it has achieved in Asia. For that to happen it needs to better define its longer-term role in SSA and must build on the fact that SSA is the region where it can have major impacts on development through the delivery of IPGs during the next decade.

The Panel considers the efforts so far to transfer of the NRM programme of ICRISAT to Africa as recommended by the 4th EPMR as unfinished business. The Panel also believes that even a significant part of the conventional plant breeding capability should be re-deployed to Africa. However, since a world class PGRE programme in Hyderabad would require more staff than currently exist in ICRISAT, the transfer of conventional breeders to Africa would necessitate replacement by highly competent regionally or nationally recruited or seconded Asian scientists.

In the Panel's view, the most desirable future option for ICRISAT is a win-win situation in which the African programmes of ICRISAT would be significantly strengthened while at the same time strategic PGRE research with a global perspective, serving ICRISAT in Africa and the NARS in Asia is maintained. The Panel believes that ICRISAT should rapidly restructure its programmes and transfer its Headquarters, and all programmes except its strategic plant genetic resources enhancement programme, to sub-Saharan Africa.

Finally, the Panel believes that this is a defining moment for ICRISAT. It must seize the enabling opportunity that now exists for the Institute to transform into a premier Centre of scientific excellence for the 21st century in the service of the people of the SAT regions in Africa and Asia. The CGIAR must offer its full support to ICRISAT to ensure that the Institute is transformed promptly to ensure that it continues to offer a high return to investment for many decades to come.

LIST OF RECOMMENDATIONS

CHAPTER 5 - THE GLOBAL THEMES

1. The Panel recommends that ICRISAT continue to undertake strategic research on genomics and transgenic product development for SAT crops; and together with the other CGIAR Centres and relevant partners, address the pressing issues on intellectual property, biosafety and public acceptance of transgenic crops.

2. The Panel recommends that ICRISAT should maximize the synergy possible when GT1 (Harnessing Biotechnology for the Poor) and GT2 (Crop Improvement, Management and Utilization for Food Security and Health) plus their partners work closely together to generate International Public Goods for the SAT. ICRISAT should rapidly re-engineer and rebuild its crop improvement programmes and further enhance the evolution of the two-pronged breeding strategy for Asia and Africa.

3. The Panel recommends that ICRISAT phases out GT3 (Water, Soil and Agrobio-diversity Management) research in Asia where it no longer has a comparative advantage, by devolving this research to NARS. These resources should be redeployed in Africa where they should be engaged in addressing some of the major challenges in land, water and agro-biodiversity research facing the SAT of that continent.

4. The Panel recommends that ICRISAT prioritize and consolidate its activities in Integrated Pest Management (IPM) and Integrated Disease Management (IDM). Potential projects should be chosen with priority being given to projects that address constraints that are important in Africa and are potentially solvable through IPM or IDM approaches.

5. The Panel recommends that ICRISAT rationalize the role, scope and objectives in terms of its comparative advantage in conducting research generating IPGs in GT4 (Seed systems). This includes addressing the anticipated problems related to marketing transgenic materials it will produce. The purposes and goals of GT4 will be best served if its activities are strongly anchored into appropriate global themes where interdisciplinarity can be enhanced and resources more efficiently and effectively utilized.

6. The Panel recommends that GT5 (Enhancing crop-livestock productivity and systems diversification) should transfer assessment of feed quality to GT2 (Crop Improvement, management and utilization) and cease its other activities in Asia. The level of staffing should be increased, and strategic research in sub-Saharan Africa expanded, particularly in landscape level research on new systems. To ensure coherence in ICRISAT's programmes this theme should be merged with GT3 (Water, soil and agro-biodiversity management).

7. The Panel recommends more vigorous implementation of the recommendations of the CCER of Socioeconomics and Policy Research Programme at ICRISAT, 1996-2001. More social science resources should be re-allocated from GT6 (SAT Futures and Development Pathways) to the other themes under the leadership of non social scientists and the work programme should be more sharply focused on strategic

assessments and activities that best inform macro and longer-run priority setting in ICRISAT.

CHAPTER 6 - PROGRAMME MANAGEMENT AND SUPPORT

8. The Panel recommends that ICRISAT should rationalize the role, scope and objectives of the Institute in the distance learning for farmers initiative called the Virtual University for the SAT and provide management with clear guidance on where the limits of ICRISAT's interest lie consistent with its comparative advantage in IPG research. Further, the term University should be replaced with a more appropriate term such as "Virtual Learning Centre for the SAT".

CHAPTER 7 - ICRISAT IN THE FUTURE

9. The Panel recommends that ICRISAT should rapidly restructure its programmes and transfer its Headquarters, and all programmes except its strategic plant genetic resources and enhancement programme, to sub-Saharan Africa.

CHAPTER 1 - INTRODUCTION:

JUSTIFICATION, BACKGROUND AND CONTEXT

1.1 Evolution of the CGIAR

The CGIAR was established in 1971 to support productivity-oriented research to raise food output, in response to specific food needs in the developing regions. During the 1970s and the 1980s, the technology-generation research in the CGIAR was directed principally towards increasing crop productivity and food output. The purpose of the accompanying social science research effort was to complement the biophysical effort to help increase food security through improved production technologies.

Through the 1980s, the international development community began to broaden its views about development, encompassing human and environmental dimensions. Aided by notions of human and civil rights, as well as of freedom and empowerment, development goals were explicitly articulated to go well beyond economic growth and diversification objectives to include poverty alleviation, equity, and quality of life concerns, including environmental sustainability. Consequently, in the late 1980s and early 1990s, there was a fundamental rethink in the CGIAR as to what constituted the central elements of its mission and goals, what research priorities and strategies could contribute efficiently to their achievement for the poor in the developing regions.

The international concerns for the poor and the environment led the CGIAR to accept that it was now addressing poverty alleviation through pro-poor research, and that the social and cultural dimensions and inclusiveness were just as relevant in achieving its goals as the more traditional biophysical, economic, policy and institutional aspects. Consequently, as the 1990s unfolded, the research agenda in the CGIAR, although still focused on increasing productivity and output, began to pay greater attention to the social and sociocultural variables and their interactions with the biophysical, economic, policy and institutional factors. Particularly, attention was focused on participatory approaches to research, and to the use and management of the resources needed for the sustained and efficient production of biological products. Attention was given also to the processes of asset management and capital formation in the context of sustainable rural livelihoods.

1.1.1 Early Years, up to 1990

During the 1970's and 1980's, the CGIAR research agenda was dominated by commodity and production related activities, with success or impact at the farm level seen largely through the adoption of modern varieties of crops. Economists in the social science units at the Centres also contributed, as they do now, to priority setting activities, and social science activities in some Centres included post-production issues such as post-harvest management, food processing, and marketing but with the aim of mainly servicing the commodity improvement programmes. This was in the context of CGIAR's interest in Farming Systems Research (FSR), taking the researcher closer to the ultimate clients and their production, livelihoods and community environments. FSR activities soon led to more sophisticated village-based socioeconomic studies, OFR and research on common property resources management, particularly as off-station and regional research programmes

expanded. In its 1987 Review of CGIAR priorities, TAC identified sustainability and NRM as priority issues. The goal statement read as follows: "*Through international agricultural research and related activities, to contribute to increasing sustainable food production in developing countries in such a way that the nutritional level and general economic well-being of low income people are improved*".

Initially, this altered interest was seen in the context of sustainable production of CGIAR commodities. However, at the MTM in Canberra in 1989, CGIAR members declared their intention to continue emphasizing the CGIAR mandate for research on sustainable agricultural production, but to expand emphasis to include research on the optimum management of forests, fisheries and water. Based on TAC's analysis on the possible expansion of the CGIAR System, the Group at ICW 1990 agreed to include water, agroforestry, forestry and fisheries into its mandate, inviting IIMI, ICRAF, ICLARM and CIFOR to join the CGIAR System.

1.1.2 Recent Years, the 1990s

In 1990, TAC concluded and the CGIAR accepted that effective research in NRM must address both the technical and the human sides of the problem at both the farm and community levels. To accommodate the expansion of the CGIAR, in 1992, the goal statement was replaced with a mission statement which read as follows: "*Through international research and related activities, and in partnership with national research systems, to contribute to sustainable improvements in the productivity of agriculture, forestry and fisheries in developing countries in ways that enhance nutrition and well-being especially of low-income people.*" The mission statement was backed up by nine closely related goals. The first five goals referred to the management of natural resources and the integration of improved commodities into sustainable production systems. The next three goals related to socioeconomics and policy environments. The last goal related to all the other goals by focusing on the development of human resources and on institution building at national or regional level.

In expanding the CGIAR mission, the old concept of *food self-sufficiency* was "replaced" with the concept of achieving *food self-reliance*, making income generating non-food commodities and reliance on markets and trade more important to satisfy the basic food and nutritional needs of low-income people. The emphasis on sustainability placed a greater emphasis on the natural resource base, ecoregions and partnerships, leading to ecoregional and other Systemwide strategies to help strengthen natural resource management research and partnerships with NARS and others. Also, issues related to equity, particularly gender equity, and common property resources, received increased emphasis.

In the mid-1990s, the CGIAR formally incorporated poverty alleviation and sustainable food security into its mission and goals. This was a deep and fundamental change in outlook and vision, and its implications on the nature, ethos and research culture of the CGIAR System soon began to make a mark. There was an increasing recognition of the importance of the "context", both physical and sociocultural, and of the variability and diversity of sociological contexts, in addressing rural poverty through improved agricultural productivity. In addition to incorporating a poverty focus into its mission, the CGIAR introduced a project-based research management system to become output driven and improve the impact of its research.

The 1997 TAC review of CGIAR priorities and strategies led to refocusing of CGIAR's overarching goal which read: "The activities carried out by the CGIAR are undertaken in order to fulfill both its mission: to contribute, through its research, to promoting sustainable agriculture for food security in developing countries and its goals: to alleviate poverty and protect natural resources so as to achieve sustainable food security." Poverty weighted adjustments to priorities and resource allocation were recommended by TAC.

1.1.3 New CGIAR Vision and Strategy, and the CGIAR Reform Process

In 2000, the CGIAR adopted a new vision and strategy recommended by TAC. The vision was defined as *"A food secure world for all"*. The overall goal was defined as *"To reduce poverty, hunger and malnutrition by sustainably increasing the productivity of resources in agriculture, forestry and fisheries"*. The mission was defined as *"To achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, livestock, forestry, fisheries, policy and natural resources management"*.

To implement the new vision, an integrated strategy of seven nested planks was endorsed by the CGIAR. The new CGIAR vision and strategy calls for, *inter alia,* an increased emphasis on pro-poor relevant research, on regional and bottom up orientation, on bringing new science to bear on the often difficult-to-address causes of poverty and food insecurity, on the reorienting of the CGIAR towards undertaking critical Challenge Programmes. With these fundamental changes, the CGIAR is entering a new phase in its development. The new phase requires a much stronger concern for higher standards of scientific relevance and quality, for keeping pace with state of the art in world research, and for being relevant, selective and targeted.

Poverty and food security issues are generally conditioned by the national and regional political and investment environment and cannot be addressed directly through IPG research. The CGIAR therefore must reconcile the divide or gap that exists across the three elements of its research strategy - the IPG nature, the poverty focus and the impact orientation – if it is to remain an effective player in the international agricultural research system. To achieve such reconciliation, the CGIAR must get the context of its research right; it must generate the most critical IPG; and it must have impact on income poverty and NRM. In the new CGIAR strategy, it is the regional approach to research that has the potential to facilitate the needed reconciliation and partnership linkages across the research-to-development continuum.

More recently, with the introduction of Challenge Programmes as part of the CGIAR reform process, the organization of research in the CGIAR is going through a further transition. For the purpose of defining programme structure, accounting and governance, the System's totality of research and research related activities are organized and implemented, accounted for and governed as a continuum of three basic types or categories of programmatic arrangements, namely: (i) *Centre Core Programmes*; (ii) *Systemwide Programmes; and* (iii) *Challenge Programmes*.

Systemwide Programmes cover sets of activities conducted by the Centre among themselves and with various national and partner institutions with specific objectives in mind. However for the most part they are organized and recognized as such to provide scientific coherence to the totality of System activities on a specific theme or problem area and to promote efficiency and effectiveness in their planning, implementation and delivery. They are

usually activities no individual Centre can pursue on its own with equal success and those activities which clearly are best conducted in partnership with others.

Challenge Programmes are organizational instruments designed not only to provide coherence and direction to System activities on a specific theme or problem area but to promote efficiency and effectiveness in their conduct as well. They are likewise intended to provide the System's impact on its stated goals of poverty alleviation, promoting food security and enhancing the sustainability of natural resources by drawing in new, additional partners particularly those involved in development and utilization of the System's research outputs, as well as those institutions leading global efforts in conventions and initiatives with similar and/or related goals. However, the introduction of Challenge Programmes is adding to the difficulties in the CGIAR System because so far it has led to further decrease in unrestricted funding, a trend which has continued since the early 1990's. Restricted funding is now generally more than 50%, and is seriously beginning to hurt the quality of science in the CGIAR System.

1.2 The Need for International Research in the SAT

In 1972 the semi-arid tropics (SAT) was home for many millions of poor people who mainly depended on agriculture and often were hungry and malnourished. In response to this situation, the CGIAR established ICRISAT to serve as an international research centre for genetic improvement of a set of cereal and grain legume crops that had been neglected by scientific institutions and were of particular importance to the food security and livelihoods of people in the SAT. In addition, ICRISAT was to develop improved rainfed farming systems for the SAT. At that time, relatively little research was being conducted on these crops in this zone, and many national programmes in the SAT were weak and lacked trained scientific staff and resources. Major constraints were present due to frequent droughts, heat, soil conditions that were unfavourable for plant growth, and numerous plant pests and diseases. Not surprisingly, little progress had been made in developing crop varieties and cropping systems that were more effective than traditional systems.

By 2003, ICRISAT had contributed to the substantial progress that had occurred in the development and adoption of improved varieties of the mandate crops and compatible rainfed cropping systems for them, especially in South Asia. Significant but less progress had been made in sub-Saharan Africa, especially with respect to the development and adoption of new varieties. In SAT areas of the Americas ICRISAT has had relatively little activity.

As of 2003, a large number of people in the SAT are still poor, hungry and malnourished (refer to Ryan and Spencer, 2001 for sources to the following statistics). In sub-Saharan Africa, 180 million people were estimated to be hungry in 1995/97 with the number projected to increase to 184 million by 2015. In South Asia, 284 million people were estimated to be hungry in 1995/97, but the number was estimated to decrease substantially to 165 million by 2015. Child malnutrition is an insidious manifestation of food insecurity. The proportion and number of malnourished children were estimated to be greater in the SAT than in any other agroecological zone. In sub-Saharan Africa, 31 million children were estimated to be malnourished in 1995 with the number expected to increase by 2020 to 43 - 55 million. In South Asia an estimated 86 million children were malnourished in 1995, but with a projected decrease by 2020 to 61 - 71 million. It should be clear, therefore, that much remains to be done to improve human living conditions in the sub-Saharan Africa and South Asia regions of the SAT.

As of 2003, grains of sorghum and pearl millet are major staple foods of most poor people in the SAT in sub-Saharan Africa, and they are important foods of many poor people in the SAT of South Asia. The majority of the cultivated area of sorghum is in Africa (23 M ha) with 10 M ha in South Asia. Average productivity in the SAT is only 1 ton/ha compared to 3-5 ton/ha that can be achieved on experiment stations in the SAT. Substantial pearl millet is grown in West Africa (12 M ha), mainly in the very dry and infertile Sahelian and Sudan zones, and in India (10 M ha). In southern and eastern Africa 2.5 M ha are grown in 16 countries. Average productivity in the SAT is only 0.7 ton/ha compared with 2 to 3 ton/ha that can be obtained on experiment stations in the SAT. Groundnut is a major oilseed and supplier of protein for people and livestock and is grown on 9.5 M ha in sub-Saharan Africa, 8.3 M ha in India and 5 M ha in China. Average productivity is only 0.9 ton/ha in Africa and India compared with 2 to 3 ton/ha that can be achieved on experiment stations in the SAT. Chickpea is an important source of protein for poor people and is grown on 8 M ha in South Asia with major production in India. In sub-Saharan Africa, chickpea is grown in Ethiopia (2% of world production) and to a smaller extent in Malawi and Tanzania. Average productivity is only 0.8 ton/ha compared with 2.5 to 3.5 ton/ha that can be obtained on experiment stations in the SAT. Pigeonpea is grown on 3.8 M ha in India and 0.4 M ha in sub-Saharan Africa. It is the classic ‘orphan crop’ in that, other than ICRISAT, few institutions have conducted significant research on pigeonpea. Yet, it is an important source of protein for poor people in the SAT and its importance is growing, especially in India and East Africa.

Research has indicated that important benefits to the efficiency and stability of crop production can occur when combining cereals and grain legumes in cropping systems. In addition, residues from sorghum, pearl millet and grain legume crops provide critical feed for livestock, especially during the dry season, and manure enhances the fertility of the soil. These linkages result in important synergies when crop production and livestock enterprises are combined in mixed farming systems. Currently, livestock are a major component of agricultural systems in large areas of the SAT, and their importance is projected to increase substantially, since as poverty declines, increases occur in the demand for livestock products. Clearly, there still are substantial opportunities for developing improved varieties of the ICRISAT-mandate crops and compatible agricultural systems that can contribute to improving the living conditions of poor people in the SAT by increasing the stability and efficiency of crop and livestock production. International research and national capacity enhancement can contribute to the development of these improved agricultural systems for the SAT in countries where national agricultural research systems are weak, such as many countries in sub-Saharan Africa, but less so in countries in SAT Asia that have stronger agricultural research systems. Mutual benefits can come to partners involved in a cooperative effort involving many countries and an International Centre.

In addition to crop sciences research, other research efforts are required to ensure that the products of crop improvement and farming systems research also achieve desired impact socially, economically and environmentally. In this regard, and given growing problems of natural resource degradation in the SAT, there is a need for international research and national capacity enhancement in natural resource management, socioeconomics and impact quantification and assessment. Scientific and technical advances in agricultural, ecological and social sciences, including biotechnology, mathematical modeling and participatory methods of research and development, have the potential to substantially contribute to the alleviation of poverty, hunger and malnutrition. These advances provide additional compelling justification for a continued and stronger international role for ICRISAT in the

SAT for those circumstances where it has a comparative advantage in research over other organizations as discussed in section 4.2.

1.3 The Evolution of ICRISAT

At the first meeting of TAC in mid-1971, a team was commissioned to examine the suggestion put forward earlier, when IITA and CIAT were being established, to address research needs of humid tropical Africa and Latin America, that an international institute for improvement of agriculture in the semi-arid tropics be established. It recommended the "establishment of, along the pattern and principle of IRRI, of ICRISAT to be located in India, which would serve as (a) a world research Centre for improvement of sorghum, millet, pigeonpea, and chickpea; and (b) a Centre to promote the development and demonstration of improved cropping patterns and systems of farming which optimize the use of human and natural resources in low rainfall, unirrigated, and semi-arid tropics. The team also recommended that "if major attention is to be given by the Institute to additional crops such as groundnut, additional resources would be required". Groundnut was added to the list of crops in 1976.

ICRISAT began formally on 5 July 1972 with the adoption of its constitution and the establishment of its Governing Board. ICRISAT defined its formal mandate, as stated in its 1973-74 Annual Report, as follows. ICRISAT is to:

- Serve as a world Centre for the improvement of grain yield and quality of sorghum, pearl millet, chickpea and pigeonpea. Groundnut will be added as a fifth crop next year.
- Develop improved farming systems which will help to increase and stabilize agriculture production through better use of natural and human resources in the seasonally-dry semi-arid tropics.
- Identify socioeconomic and other constraints to agricultural development in the semi-arid tropics and to evaluate alternative means of alleviating them through technological and institutional changes.
- Assist national and regional research programmes through cooperation and support and contributing further by sponsoring conferences, operating international training programmes, and assisting extension activities.

In 1982, the Institute celebrated its 10th anniversary with no further change in its formal mandate beyond the addition of the ground nut crop. By that time ICRISAT had research teams or scientists located in Mexico, Mali, Burkina Faso, Niger, Nigeria, Sudan, Kenya, Malawi, Zimbabwe, and Syria. In 1986, the ICRISAT Sahelian Centre (ISC) was established at Niamey, Niger, to serve as a regional centre for research and training.

Some two years before its 20th anniversary, ICRISAT developed its first Strategic Plan which was approved by its Board in 1990. Finger millet was added to the mandate crops because of its importance in eastern and southern Africa. According to the Plan, ICRISAT's strategy for combining research with technology exchange was based on the concept of centres, teams and networks. ICRISAT Centre in India serves as the global Centre where most of the strategic and upstream applied research and most of the advanced training is being done. ICRISAT Sahelian Centre serves as a regional centre where some strategic research and most of the applied research relevant to the West African semi-arid tropics and training are conducted.

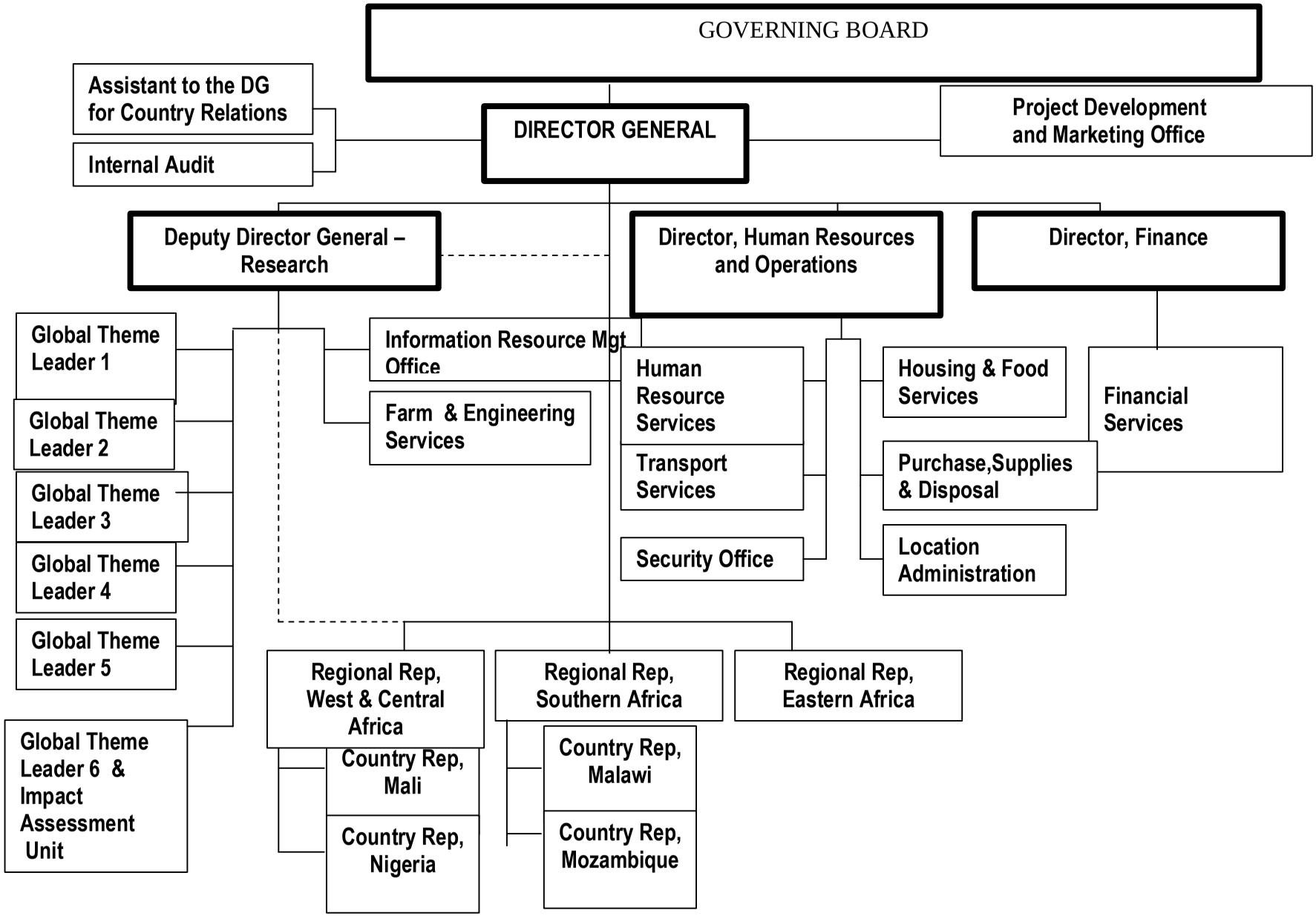
In 1993, ICRISAT restructured itself into a corporate organization with four regional entities: Asia, Southern Eastern Africa (SEA); West and Central Africa (WCA); and Latin America and the Caribbean (LAC). The former ICRISAT Centre comprised the Corporate Office and the ICRISAT Asia centre (IAC). The ISC at Niamey served as the regional headquarters for WCA, together with the teams at Kano, and at Bamako. The facilities at Matopos (Zimbabwe) served as regional headquarters for SEA, together with teams at Lilongwe (Malawi), Nairobi and Addis Ababa. No special facilities for LAC region were established. For each region, a Regional Executive Director (RED) was appointed for the management and support of research focused on the main production system of that region.

To facilitate the definition, development, management and conduct of global research and related projects, a multi-dimensional matrix management system was developed and introduced in 1994. The axes of the matrix were designed to emphasize shared responsibilities, goals and outcomes through development and delivery of a global research project portfolio with disciplinary input and regional foci. In contrast with the earlier hierarchical set up, the objective of the matrix approach was to devolve the responsibility for the management of research and resources to project teams and leaders, along with increased accountability.

At the time of the 1990 EPMR, ICRISAT's programme comprised 280 projects. In 1995, these were reduced to 22 global projects, and further reduced to 12 in 1997. The reduction in the number of projects was guided by the need for more focus and integration of related projects. The research projects were based on the 92 core research themes embedded in the ICRISAT 1994-98 MTP. The 22 projects were composed of 15 commodity projects on 5 mandated crops, 4 integrated systems projects that focused on multi-commodity systems, 2 projects on markets and policy and impact assessment, and a genetic resource project. At that time, ICRISAT allocated 52% of its resources to increasing productivity; 19% to protecting the environment; 8% to saving biodiversity; 7% to improving polices; and 14% to strengthening NARS. Regional resource allocation was 56% to Asia and 44% to Africa.

In 1998, ICRISAT restructured its research and research-related activities into four programmes: Genetic Resources and Enhancement (coordinated from Patancheru); Natural Resources Management (from Bamako); Socioeconomics and Policy (from Matopos); and Information Resource Management (from Patancheru), with a portfolio of 10 projects. In 2000, ICRISAT began the formulation of a new vision and strategy to 2010 that was recast for implementation in 2002. The Institute's new vision was defined as: "Improved well-being of the poor of the semi-arid tropics through agricultural research for impact" Its mission was defined as: "to help the poor of the semi-arid tropics through science with a human face and partnership-based research, and to increase crop productivity and food security, to reduce poverty, and to protect the environment in SAT farming systems."

Figure 1.1 New ICRISAT O&M Structure (Effective 1 February 2003)



The current research programme structure (Figure 1.1) comprises six global research themes: GT1 – Harnessing Biotechnology for the Poor comprising five regional projects and with the Global Theme Leader (GTL) based at Patancheru; GT2 – Crop Improvement, Management and Utilization for Food Security and Health (formerly Crop Management and Utilization for Food Security and Health) comprising five regional projects and with GTL based in Patancheru; GT3 – Water, Soil and Agro-biodiversity Management for Ecosystem Resilience comprising four regional projects with GTL based in Matopos; GT4 – Sustainable Seed Supply Systems for Productivity comprising four regional projects with GTL based in Nairobi; GT5 – Enhancing Crop-Livestock Productivity and Systems Diversification comprising three regional projects with GTL based in Niamey; and GT6 - SAT Futures and Development Pathways comprising six regional projects with GTL based at Patancheru. In Africa, there are three regional teams – West and Central, Southern and Eastern.

Resource allocation across five CGIAR outputs in 2002 was: 10.8% Germplasm Collection; 31.2% Germplasm Improvement; 29.4% Sustainable production systems; 15.6% Policy; 13.0% Enhancing NARS. Regional resource allocation was 51.1% to Asia and 48.9% to Africa.

1.4 ICRISAT Response to the Fourth EPMR

The 4th EPMR covered the period from 1991 to 1996. The EPMR contained 10 explicit recommendations and 67 more or less strong suggestions. Some powerful suggestions were not highlighted but could be detected by careful reading of the report. Some of the recommendations and suggestions in the report, if adequately addressed, would have required significant changes in the types and extents of financial commitments from the donor community. However, the downward spiral in core-funding of ICRISAT, already obvious in 1997, has not changed since. The action taken by the Centre should be seen in that light. As usual, the Institute responded to the recommendations and suggestions and either agreed to accept them or took issue with them. For the benefit of the EPR, a document was prepared by ICRISAT laying out the actions taken by the Centre.

The response to the first 2 recommendations related to Genetic Resources research is worthy of praise. Also the recommendations related to partnership have been actively addressed but in the area of NRM could still be improved (CCER-NRM). One of the other major research recommendations, to transfer the NRM programme to Africa, can be considered as unfinished business (CCER-NRM). Overall, the EPR Panel thus considers the actions taken in the research domain over the past 6 years in response to the 4th EPMR to be of mixed quality. In part, this may have been directly related to disagreements that existed within and between management and the board (see chapter 6) which seem to have been sorted out at the time of this review. There is little doubt that the resulting turbulence has delayed the ability of the Centre to deal with these issues, but the ever existing or looming budget crises and the staff adjustments needed to deal with them will have played a role as well.

ICRISAT's action in response to the recommendations of the 1997 External Review is tabulated in Appendix V, together with this Panel's comments. The Panel has provided its assessment of ICRISAT's actions in the appropriate sections of this report.

CHAPTER 2 - ICRISAT'S ACHIEVEMENTS AND IMPACT

2.1 Centre-Wide Recognition

During the last five years, ICRISAT has received the King Baudouin Award of the CGIAR on two occasions. In 1998, ICRISAT was recognized for "its development of high-yielding and disease resistant pigeonpea varieties and their contribution to agriculture and human welfare in developing countries." In 2002, with ICARDA, ICRISAT was recognized "for developing new chickpea varieties with higher tolerance to drought and heat, and better resistance to pests and diseases that provide stable and economically profitable yields." The significance of these awards is that they are presented only once every second year. It is remarkable that ICRISAT gained two out of the three awards available during the last five years in competition with the other fifteen international Centres of the CGIAR. While crop improvement was a central feature of the awards, the Panel considers them as being Centre-wide recognition because of the extensive team-work that took place. The following summary shows the remarkable achievements that can be made by international Centres in the specific circumstances where they have a major comparative advantage over other research institutions.

Documentation for the 1998 award to the pigeonpea programme shows how ICRISAT took a crop on which little research had been conducted and transformed it into a much more important crop. The new varieties and management methods that were developed by ICRISAT have provided many poor malnourished people in India and other parts of Asia with more protein and are beginning to have beneficial impacts in East Africa. Several significant scientific achievements were identified in the 1998 ICRISAT document "From Orphan Crop to Pacesetter – Pigeonpea Improvement at ICRISAT".

A major germplasm collection was developed for pigeonpea and classical studies enhanced scientific understanding of the collection by revising taxonomic classifications and ideas concerning the centre of origin of the crop species. By exhaustive screening of the germplasm collection, accessions were discovered with resistance to a major disease, fusarium wilt, which were evaluated by ICRISAT and a network of national programme collaborators. Through breeding, ICRISAT developed varieties with resistance to fusarium wilt that economic studies showed to have generated massive benefits to poor farmers. Yields of traditional pigeonpea were very low for a crop with a growing season of 6 to 10 months. Innovative reconstruction of the plant by breeding, guided by enhanced understanding of plant physiology, generated a radical new plant type that opened up new cropping-system opportunities triggering a major geographic extension of the crop on a world-wide basis, including a doubling of the crop area in India. The new plant type has a growing season of only 3 to 4 months and is short and compact, whereas the traditional varieties are tall and treelike. The new short-duration varieties were shown to require a substantial increase in sowing density. On-farm trials in India demonstrated that the improved variety/management package not only enhanced yields considerably, the crop also matured several months earlier so that farmers could sow their staple post rainy season crops on the same field. Some of the substantial impacts from the extensive adoption of this system in India were quantified by economic studies. A basis for future progress in India was established by developing pigeonpea as the world's first food legume hybrid to go into commercial production with a yield boost due to hybrid vigor of 25%. Use of hybrid types of varieties is particularly

important in pigeonpea because pure line varieties are not very stable due to significant out-crossing (25-30%), although there is not sufficient out-crossing to maintain the crop as open-pollinated populations. A major pigeonpea improvement project was launched in East Africa that was coordinated by ICRISAT and resulted in the release of pigeonpea varieties in Kenya, Malawi and Uganda.

ICRISAT's contribution to the research that was recognized by the 2002 award included developing chickpea varieties and complementary management methods that have substantially expanded production on residual-soil-moisture rainfed conditions in India. Of particular importance was the development of short-duration varieties that escape terminal drought and also have some resistance to heat and fusarium wilt. In addition, innovative biological control methods have been developed to control pod borer, including a spray treatment with nuclear polyhedrosis virus that is less hazardous and costly than synthetic chemical pesticides. A cost-effective technology for producing the nuclear polyhedrosis virus has been developed and transferred to some villages in India. These management methods and varieties have revolutionized tropical chickpea farming and the range of the crop has moved far south of its historical zone. For example, there has been an increase in area cultivated in Andhra Pradesh state of India from 60,000 ha in 1986 to 400,000 ha in 2002. Concurrently, productivity in Andhra Pradesh increased from 260 kg/ha in 1986 to 1000 kg/ha in 2002. The new short-duration varieties of chickpea also have become popular in four other Indian states and Myanmar. In addition, ICRISAT-derived chickpea varieties have made possible increases in chickpea production in Bangladesh, Nepal, Ethiopia, Australia and Canada. Some of the substantial impacts of the new chickpea production systems were quantified by economic studies (section 2.2.3).

A basis for future progress with chickpea breeding was established by developing the first DNA-marker-based linkage map in collaboration with ICARDA and advanced research institutes in Germany and the United States. In the future, DNA-marker-assisted selection may enhance breeder's ability to manipulate traits such as high root mass which ICRISAT has shown to enhance drought resistance of chickpea grown on residual soil moisture. Also, ICRISAT has produced transgenic chickpea plants with putative resistance to *Helicoverpa* pod borer using Bt genes and soybean trypsin inhibitor. Varietal resistance to pod borer would represent a major breakthrough, enabling farmers to more completely overcome this critical pest problem.

2.2 Genetic Resources and Enhancement

ICRISAT serves as a world centre for the improvement of sorghum, millet, groundnut, chickpea and pigeonpea. The crop improvement work was covered under the Genetic Resources and Enhancement Programme (GREP) during the period 1998-2001, when ICRISAT adopted a programmatic structure based on the 1996 EPMR; and GT1 (biotechnology) and GT2 (crop improvement and management) for a brief period during 2001 when a new O&M set up was anchored on six global research themes. During these periods, ICRISAT went through a period of multiple changes in leadership, reduced funding, paradigm shifts and downsizing. The Panel highlights the following scientific and technical accomplishments and impacts achieved during the review period notwithstanding the difficult and challenging conditions.

2.2.1 Biodiversity

Collection and repatriation. The Genetic Resources Unit of ICRISAT has had substantial accomplishments since the last EPMR including collection, maintenance and extensive characterization of germplasm. The Rajendra S Paroda Genebank at Patancheru currently has a very large active collection of the mandate species comprising 113,849 accessions (Table 2.1). In addition, a regional gene bank of 6,000 groundnut accessions has been established at Niamey, West Africa to support African germplasm enhancement and breeding programmes. Since 1997, 52,493 accessions have been placed in long-term storage in the Patancheru genebank (Table 2.1) bringing the total number of the accessions under long-term storage to 76,610 in 2002. The genebank distributed 65,752 seed samples (Table 2.1) to users in 80 countries from 1997 through 2002. As part of ICAR/ICRISAT Partnership Projects, the genebank repatriated to India (NBPGR) seeds of 39,559 accessions during 1998 to 2002. An additional 51,823 samples were used within ICRISAT for evaluation and regeneration from 1997 through 2002.

Table 2.1 - Current accession holdings and sample distributions by the Rajendra S Paroda Genebank, Patancheru, ICRISAT

Crop Species	Active collection as of 2003	Placed in long-term storage		Samples distributed during 1997-2002
		1997-2002	Total	
Sorghum	36,774	25,198	31,669	16,229
Pearl millet	21,594	9,984	15,150	6,148
Finger millet	5,014	4,620	4,620	6,256
Foxtail millet	1,534	1,054	1,054	1,445
Proso millet	841	--------	--------	193
Little millet	460	--------	--------	589
Kodo millet	547	--------	--------	47
Barnyard millet	743	--------	--------	154
Chickpea	17,258	8,713	14,766	11,786
Groundnut	15,419	2,106	6,366	14,605
Pigeonpea	13,548	818	2,985	8,300
Total	113,849	52,493	76,610	65,752

Management and characterization. The value of the germplasm collections by scientists has been enhanced. Assessments of the genetic diversity of the collections were made by analyzing passport data, and characterization data and DNA markers. This information was used to establish core collections. The core collections were characterized for morphological traits and evaluated for agronomic and quality traits to establish mini-core subsets. This approach ensured that the cores and mini-cores encompass much of the genetic variability in the active collections (Table 2.2). Under-represented world regions in the pearl millet, chickpea and groundnut collections were identified by analysis of passport and characterization data. This information will permit prioritization of future germplasm collection missions.

Storage of groundnut seed is expensive. Analysis of eight years of data on storage established that the old system used in the active collection involving in-shell storage is only marginally more effective in maintaining seed viability than seed storage. The cost of seed storage is only 64% that of in-shell storage so seed storage is now being used at the Genebank for medium-term storage.

Table 2.2 - Core and mini-core collections of the ICRISAT mandate crop species

Crop species	Number of accessions used	Number of traits used	Type of core	Number of accessions in the core/mini-core
Sorghum	22,473	20	core	621
Pearl millet	16,603	11	core	1,600
		11	mini-core	504
Chickpea	16,000	22	core	1,956
		22	mini-core	211
Groundnut	14,310	14	core	1,704
		14	mini-core	184
		14	Asian core	504
Pigeonpea	11,343	11	core	1,255
		11	mini-core	133

Wild species and unadapted germplasm. New sources of resistance to diseases and other pests have been found in the collections. Notable of these are resistance to rosette virus, early leafspot (ELS), late leafspot (LLS), bud necrosis virus and rust in groundnut; pod borer (*Helicoverpa*), sterility mosaic virus, *Phytopthora* blight (P2 isolate) and cyst nematode in pigeonpea, and *Ascochyta* blight, *Botrytis* grey mold in chickpea. New genes have been found for cytoplasmic male sterility in pigeonpea which permit the production of hybrid varieties. Genes for broad spectrum resistance to multiple stresses were identified in wild *Cajanus* and wild *Arachis* accessions. Genes have been found for the yellow endosperm trait (high beta-carotene content) in an unadapted pearl millet accession from Burkina Faso.

2.2.2 Biotechnology

Significant accomplishments were made by ICRISAT in biotechnology during the period under review. Notable achievements are the following:

Wide crosses. Achievements have been made in the use of wild relatives. They have important genes/traits that breeders could not access due to difficulty in making hybrids between the wild and cultivated species. ICRISAT now has produced the first hybrids between pigeonpea and *Cajanus platycarpus*, thereby transferring resistance to *Phytophthora* blight from the wild species. In addition, hybrids were produced between pigeonpea and *Cajanus acutifolius*, which transferred resistance to *Helicoverpa armigera* (pod borer) from the wild species. For groundnut, hybrids were produced for the first time with wild species from different sections of *Arachis*. These wild species have resistance to various foliar fungal diseases, *Aspergillus flavus* colonization, which is responsible for aflatoxin contamination, and some insect pests. Embryo rescue techniques were developed to produce hybrids between chickpea and the wild species *Cicer pinnatifidium*. This wild species has been incompatible

with chickpea when conventional hybridization was attempted and has high levels of resistance to two major diseases of chickpea, Fusarium wilt and Ascochyta blight.

Applied genomics and transgenics. Prior to 2000, ICRISAT had lagged behind some CGIAR centres scientifically and operationally in its efforts to integrate new science and tools in its crop improvement programme. The Panel considers the establishment and operation of the Applied Genomics Laboratory as a significant achievement. Its establishment enabled ICRISAT to develop various IPGs in a short period. These IPGs include developing:

a) *de-novo* and *in-silico* microsatellites (SSR) in groundnut, *de-novo* EST and *in-silico* SSR markers for chickpea, SSR markers for pearl millet and pigeonpea in collaboration with ARIs, which were used to characterize the germplasm holdings of ICRISAT, to constructs maps for comparative genomics of sorghum and other cereals, to map traits for resistance to diseases and pests such as stem borer and shoot fly resistance in sorghum, *Ascochyta* and *Botrytis* resistance plus root hairs in chickpea, and late leaf spot and rust resistance in groundnut, and to integrate marker technology through MAS in a pearl millet drought resistance breeding programme.

b) protocols for high throughput genotyping, genomic databases, and on-line laboratory information/data management system.

c) efficient transformation and regeneration protocols for all ICRISAT mandate crops, except pearl millet, which are significant breakthroughs that led to the development and field evaluation of transgenic products such as groundnut with replicate gene of Indian Peanut Clump Virus (IPCV), transgenics with a Bt gene for podborer resistance in pigeonpea, and groundnut with coat protein gene of Groundnut Rosette Assistor Virus (GRAV), the latter for eventual deployment in Africa, where the disease is devastating.

Diagnostics. After many years of research, a major breakthrough was made by ICRISAT in 2000 through the identification and characterization of pigeonpea sterility mosaic virus. Another notable achievement is the development of a simple and robust diagnostic ELISA assay for aflatoxin. Aflatoxin contamination of groundnut grain and its products is a serious health hazard for humans and livestock in South Asia, sub-Saharan Africa and elsewhere in the world. Available procedures for detecting aflatoxins were time consuming and expensive and were not suitable for automation. In collaboration with the Crops Research Institute, Scotland, ICRISAT has developed a simple and robust ELISA assay for quantifying and estimating aflatoxins which only costs about US$1 per sample, compared with US$8-12 by earlier methods. Small feed producers and poultry farmers in India are now using this ELISA assay to evaluate the extent of feed contamination with aflatoxins. The ELISA kit has potential for commercialization with Private Sector Companies. ICRISAT breeders are using the assay to develop groundnut cultivars with low levels of aflatoxin in grain. In addition, ICRISAT is using the assay together with GIS technology to evaluate the extent of the aflatoxin problem in the human and livestock food-chains.

2.2.3 Germplasm enhancement

Since the last EPMR, ICRISAT has many achievements in germplasm enhancement that have resulted in substantial beneficial impacts in addition to those discussed in section 2.1 that resulted in the two King Baudouin awards to the pigeonpea and chickpea

programmes. In the following discussion ICRISAT-derived cultivars refers to either cultivars bred by ICRISAT or cultivars selected or developed from ICRISAT germplasm. Impacts depend upon the area on which a new cultivar is grown and the value of the cultivar in relation to cultivars previously used by farmers. Information of this type is available for some of the cultivars developed by ICRISAT. This discussion only covers those achievements and impacts that were brought to the attention of the Panel and are considered particularly important.

Pigeonpea. In three states in India, 800,000 ha are cultivated with two ICRISAT-derived cultivars (ICP 8863 named Maruti and ICPL 87119 named Asha). Maruti has resistance to *Fusarium* wilt and early maturity and the total net value of benefits was projected at US$61.7 m in 1996 with an internal rate of return on investment of 65%. Another four ICRISAT-derived cultivars are being grown on 85,000 ha in southern and eastern Africa. Sources of cytoplasmic male sterility and fertility restorers have been discovered that could increase the effectiveness of systems for producing hybrid varieties of pigeonpea.

Chickpea. A large area of chickpea (7-8 million ha) is now cultivated in India. The new ICRISAT cultivar ICCV 1, which was adopted in Gujarat State, produced 84% more net income than the local variety and had a 23% reduction in unit costs of production that would benefit poor farmers. In five districts of Maharashtra State, chickpea cultivars developed by ICRISAT occupy 38% of the total chickpea area and bring an additional net benefit of US$80 per ha, which represents an increase in net returns of 86% over that of the local variety, Chafa. In five districts in Andhra Pradesh State, ICRISAT chickpea cultivars are used in 33% of the area and bring an additional net income of US$55 per ha compared with the traditional major variety, Annigeri. With respect to other countries, ICRISAT-derived chickpea cultivars have been released and adopted by farmers in Bangladesh (14,000 ha), Myanmar (120,000 ha), Ethiopia (30,000 ha), Canada (160,000 ha) and Australia.

Groundnut. Several ICRISAT-derived cultivars have been adopted in India with a roughly estimated area of the new cultivars of 500,000 ha in 2003. Substantial progress also has been made in Africa. The medium-maturity ICRISAT cultivar CG7 is being grown on 30,000 ha in Malawi and has been adopted by 50% of farmers in Zambia. A medium-maturity ICRISAT-derived cultivar with rosette virus resistance, ICGV-SM 90704, was released in Malawi in 2000. The early maturing ICRISAT-derived cultivar Nyanda is becoming popular among farmers in drought-prone areas of Zimbabwe where it is being grown on 10,000 ha. From materials supplied by ICRISAT, the Seed Co. Limited of Zimbabwe has identified a short-duration rosette virus resistant cultivar for release, ICGV-SM 99537, that should further enhance the stability of groundnut production in drought-prone areas of southern Africa. An early maturing ICRISAT-derived cultivar, ICGS 36E, has been adopted on 20,000 ha in Mali. A foliar disease resistant cultivar, ICG 7878, also has been released that is enhancing the livelihoods of the poor in the Kolokani region of Mali. Several confectionary groundnut cultivars bred by ICRISAT have been shown to be very effective when grown under irrigated conditions in Senegal. An early maturing rosette virus resistant cultivar bred by ICRISAT, ICGV-IS 96894, has been released in Nigeria, the largest groundnut producer in Africa. This cultivar has restored farmers' confidence in growing groundnut while confronting the most devastating disease of the crop in sub-Saharan Africa – the disease caused by the rosette virus.

Pearl millet. The greatest impacts have occurred in India with some impact in Africa. Hybrid varieties are grown on 60% of the pearl millet area of India and 60 of the 70 hybrids that were cultivated in 2002 have ICRISAT-bred parental lines or were developed from

ICRISAT germplasm. Most pearl millet seed production in India is done during the summer by farmers in Andhra Pradesh and Gujarat States. One district of Andhra Pradesh (Nizamabad) is estimated as generating an additional income of US$2.5 million per year to these farmers. The ICRISAT-bred open-pollinated cultivar, ICTP 8203, was released in Maharashtra and Andhra Pradesh States and has been adopted on 100 000 ha within one year of its release. The success of ICTP 8203 and related cultivars demonstrated that the *iniari* group of landraces is the most valuable germplasm of pearl millet identified to date.

With respect to Africa, open-pollinated cultivars have been released that often had improved adaptation to terminal drought through earlier flowering and shorter cycle length. The ICRISAT discovered landrace Okashana 1 is currently grown on 100,000 ha in Namibia accounting for 50% of the total pearl millet area in the country. The ICRISAT-derived cultivar GB 8735 is grown on 30,000 ha in West Africa and SOSAT-C88 is grown on 50,000 ha in Nigeria. In Tanzania, the ICRISAT-derived cultivar Okoa has been adopted on 80,000 ha which is 27% of the total pearl millet area in the country. The ICRISAT-derived cultivar ICMV 221 has been adopted on 40,000 ha in Kenya and Eritrea.

Sorghum. Substantial impacts have occurred in both India and Africa. Hybrid varieties are grown on 4 million ha (80%) of the rainy season production area and 1 million ha of post rainy or rabi-season area in India. Out of 50 hybrid varieties that are being grown, 70% were released by the private sector and 75% of them were bred using ICRISAT-derived parental lines or germplasm. Eight private seed companies acknowledged that their most promising hybrids were based on ICRISAT-bred germplasm. The private sector has joined the sorghum hybrid parents diversification consortium, which is similar to the pearl millet hybrid parents consortium, and provides continuing grants to the ICRISAT breeding programme which illustrates how much they value ICRISAT-bred germplasm. The diverse male-sterile and restorer lines developed by ICRISAT are of substantial value to many national programmes. A total of 70,665 seed samples of these lines were supplied to 52 countries during 1996-2001.

With respect to Africa, ICRISAT-derived inbred-line cultivar Macia is grown over 20 to 30% of the sorghum area in Eritrea, Kenya, Mozambique, Namibia, Tanzania and Zimbabwe. Inbred-line cultivar Gadam el Hamam is being adopted by farmers in Kenya, and Pato is being adopted by farmers in Tanzania. An ICRISAT-derived inbred-line cultivar, Phofu, which has adaptation to late-season drought due to early maturity and stay green foliage, has been adopted by 21% of farmers in Botswana. ICRISAT-derived inbred-line cultivar S35, also called ICVS 111, has achieved 10 to 15% adoption in Nigeria and Ghana, and ICSV 400 is popular in Nigeria. The extra-early inbred-line cultivar CSM 63 is being accepted by farmers in West and Central Africa. Seven new lines belonging to the Guinea race of sorghum have been released by the ICRISAT breeding programme in Mali. This race is grown by many farmers in Mali and some farmers in other countries in West Africa. Prior to this time only landraces of Guinea race sorghums were available to farmers.

2.3 Crop and Natural Resources Management

ICRISAT has made important achievements in integrated pest management (IPM) in India. Working with NARES and NGOs in a participatory mode with farm communities, they developed IPM methods for controlling legume pod borer in both pigeonpea and chickpea. These IPM methods combine new technologies, such as biological control using a virus and fungi, with traditional techniques, such as manual shaking and taking advantage of birds by

placing perches in fields. ICRISAT developed a relatively simple and practical method for producing the virus that is used in the biological control. The IPM approach is being adopted, and in the first "IPM village" in Maharashtra State almost no insecticide is being used and production costs have been substantially reduced.

Of equal high quality are ICRISAT's achievements in integrated disease management (IDM) in Asia. Techniques were developed for reducing botrytis gray mold in chickpea that have been adopted by 10000 farmers in Nepal. For groundnut in India, reductions in collar rot, stem rot and bud necrosis have been achieved by using resistant cultivars. Combinations of resistant cultivars, early sowing and appropriately timed fungicidal sprays have been shown to substantially reduce yield losses caused by foliar diseases. In 2000 there was a sudden outbreak of a serious peanut stem necrosis disease in Andhra Pradesh that caused extensive damage with an estimated loss of US$60 million in one year. The causal agent of this disease (tobacco streak virus) and its alternate hosts were identified, and a package of control measures was devised by ICRISAT and its partners that was adopted on 0.5 million ha in 2001. Since then, the State Department of Agriculture in Andhra Pradesh has taken over responsibility for extending the IDM package and ICRISAT staff provided technical back stopping.

The EPR Panel had greater difficulty detecting any substantial verified achievements in the Natural Resource Management Programme (NRMP).

ICRISAT claims the following IPGs from the NRM work:

1) Improved participatory research methodologies for NRM
2) Improved simulation modeling capability and application in smallholder farming systems research
3) Methodologies for watershed development and soil fertility management
4) Introduction of legumes into rice and wheat fallows

The EPR Panel first examined a centre commissioned external review (CCER) conducted in 2000. The CCER team cautions that any claims of success in the NRM field (such as micro-dosing of fertilizers) could be challenged as they have many creators and advocates. They are positive sign of the quality and effectiveness of the partnership. The Watershed research was judged as classical, yet of little significance to farmers so far (see also IFPRI Research Report 127). Although the CCER Panel felt that the potential impact of the NRM research might be large, the report warns that ICRISAT is under pressure to prove that the returns on the investments in NRM research, particularly the modeling work, will have a pay-off in the near future. The Panel took note of the fact that ICRISAT has recently received funding for participatory watershed development in Asia. This is an indication of the continued interest of some donors in this area of work.

Systems diversification through the introduction of legumes into rice and wheat fallows has been pursued in the Indo-Gangetic plains of South Asia. This system improvement was built on extensive nutrient balance studies involving legumes carried on-station and on-farm, followed by the use of GIS to identify the potential for, as well as potential sites for, legume diversification.

As a second source of information, the briefing report ICRISAT prepared in February 2003 for the EPR Panel made mostly the same claims as the earlier briefing paper prepared for the CCER. The ICRISAT document adds as an accomplishment, the approach to community-level fertilizer introduction being explored in collaboration with the FAO in Niger (Warrantage). This approach is a progression of earlier pilot studies conducted with IFDC-Africa with funding from the World Bank and USAID. The project adopts the ICRISAT/IFDC/University of Hohenheim micro-dosage approach and is largely financed and coordinated by the FAO with assistance from the micro-credit scheme of GTZ. Farmers are given credit against secure stockpiling of their grain following harvest in order to pursue alternative income generating activities, and return the credit when they sell these products at competitive prices late in the dry season. The FAO representative in Niger emphasized the importance of the partnership with ICRISAT in this pilot scheme, but the current scientific contribution of ICRISAT appears small. Surprising to the EPR Panel, necessary accompanying research, such as long-term studies to assess the accumulated effect of micro-dosing or the proposed elimination of K from the fertilizer recommendation for the Alfisols/Entisols-complex of West Africa has not been taken up by ICRISAT. The soil fertility problems of Africa remain largely unsolved.

2.4 Socioeconomics and Policy

Over the 1996-2001 period the CCER noted that the Socioeconomics and Policy Programme made five main types of contributions towards achievements of ICRISAT's goals:

1) Helping to set ICRISAT's research priorities and the definition of its research agenda
2) Contributions to the socioeconomics knowledge base for the SAT
3) The development of analytical and methodological tools for use by NARS
4) Provision of information and analysis to inform policy making
5) Strengthening capacity among national partners

With regards to its mandate of producing IPGs, this Panel concurs with the CCER that social scientists have made some methodological/analytical contributions including:

1) Approaches to developing typologies of production systems that combine socioeconomic and agroecological factors using participatory approaches
2) Development of conceptual frameworks for analyzing institutional change and networks in agricultural innovation systems, with special references to public interactions and post harvest systems
3) Contributions to experimental economics, especially pilot action research on input-supply strategies for small or marginal areas (e.g. pilot testing of small packs of seed and fertilizer)
4) Contributions to trade analysis for decision making in the setting of research and development agendas

However, the contributions have been less than should have been expected, given the size of the programme and the history of significant contributions to knowledge made in previous periods. For example, although Village Level Studies (VLS) data collection was re-launched in 2001, only a small start has been made by ICRISAT in studying the dynamics of change using the database which is ideal for such analysis. Impact assessment studies used

standard economic surplus methods, and missed the opportunity as probably the activity consuming the largest proportion of socioeconomics budget in the CGIAR, to make contributions to tackling current methodological issues in impact assessment. These include the problems of partitioning benefits between NARS, IARCs and extension systems, or analysis of the impacts of unintended or inappropriate outputs within the CGIAR. An encouraging start has however very recently been made in identification of difficult methodological issues in assessment of NRM impacts.

None the less GT6 and its forerunner, the Socioeconomics and Policy Programme have had discernible impacts in a number of areas, as shown by the examples in the CCER. These include impacts within ICRISAT (regular contributions to priority setting and allocation of resources), impacts on policy (re-designing of emergency seed distribution systems in Southern Africa, increased funding of ICRISAT programmes), impact on NARS capacity (priority setting and impact analysis), impacts on the private sector (revised approaches to seed marketing in Southern Africa), and impacts on gender analyses.

2.5 Information Management

According to ICRISAT, accomplishments in information management during the review period include: the establishment of an institute-wide information platform, or a global intranet; the e-Library initiated through IRMP in 2001; and the setting up of five types of learning initiatives: scholarly studies, joint project attachments, specialized skills course, ICT-enabled learning, and computer-based tutorials. ICRISAT adopted a MS-Window based client-server computing architecture, a transition from the VAX computing platform. It also created an institute-wide connectivity and networking infrastructure, offering a virtual collaboration and conferencing facility, and established a Internet web site service for the entire Institute. In the area of library and documentation, ICRISAT developed an Electronic Library.

All the above listed accomplishments are considered by the Panel as “moving forward with the times” in making use of the potential of ICT for connectivity and networking, and for information sharing and dissemination. ICRISAT is commended for the emphasis on knowledge sharing within the Institute, and the establishment of an Institute-wide information platform, or a global Intranet. The pilot ICT-based open distance learning initiative for sharing information and knowledge, and skills with poor communities is dealt with in section 6.4.

CHAPTER 3 - QUALITY OF ICRISAT RESEARCH, OUTPUTS AND STAFF

3.1 Priority Setting

Since the last EPMR, there has been little in the form of a formal mechanism in place at ICRISAT by which priorities are set, even though the staff continued to contribute methodological papers on the subject. Under pressure of the donor community, the Centre has increasingly taken into consideration the development agenda of the community and of the stakeholders. As pressure on the budget increased, ICRISAT has strategically broadened its scope and interacted with an ever increasing number of stakeholders and donors, greatly complicating the resolution of diverging agendas and reconciliation of these diverse interests with the mission of the centre.

For a view of the evolution in priorities as the Vision and Strategy of the Centre has shifted the Panel first consulted the Medium Term Plans (MTPs). Although these provided an insight into the project portfolio dynamics, the frequent restructuring of the research programme structure makes an analysis of the changes in priorities difficult to discern. The Centre's MTPs generally provided the results of a presumed priority setting exercise but little in terms of how this was arrived at.

The Panel requested the Centre to indicate which areas of research were dropped, de-emphasized and taken up in the past 7 years, and why. The response showed that large parts of the research agenda were terminated because the mission was accomplished or because the problem had resolved itself or was not likely to be solved with the resources at hand. But, many topics also were dropped because of a lack of funding, in part due to donor fatigue. The areas taken up were largely in line with the newest Vision and Strategy

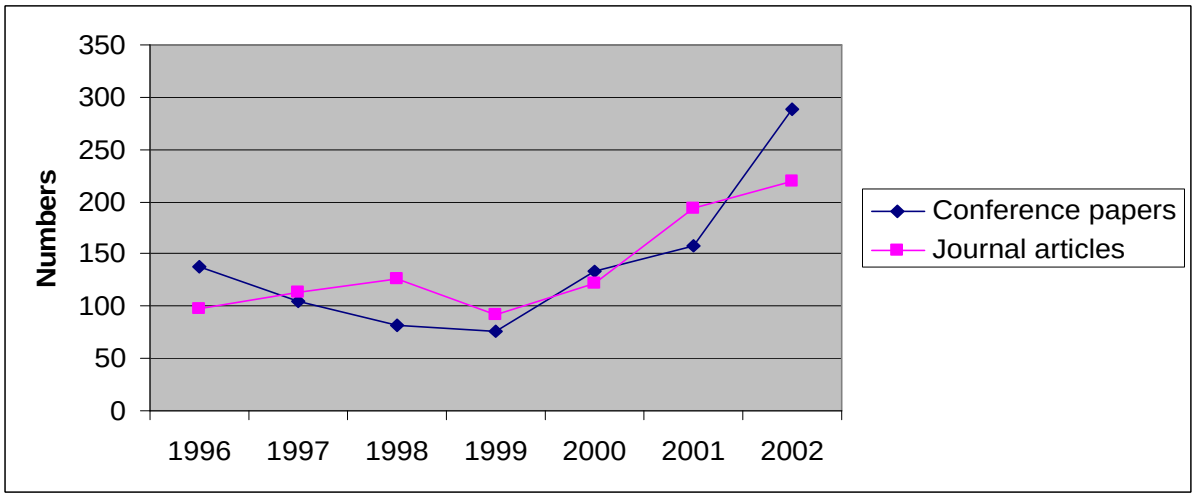
By its own admission, the Centre lacked a deliberate process of weighing one option against another in generating its research agenda during the review period. This is surprising given the wide mandate and the multitude of challenges of the Centre in terms of geography, disciplines, crops and production systems. The result has been a rather scattered, sometimes poorly balanced research agenda over which opportunities for funding and personal interests have had undue influence. This is not to say that ICRISAT has not addressed very serious issues and has not been successful.

The Centre is aware of the problem and since 2000 has been engaged in a full-fledged regional and global priority setting exercise which is based on the Vision and Strategy Until 2010 (see section 4.1). This has been very much welcomed by its staff. The results and effectiveness of this priority setting exercise mechanism will need to be assessed in the years to come.

3.2 Publications

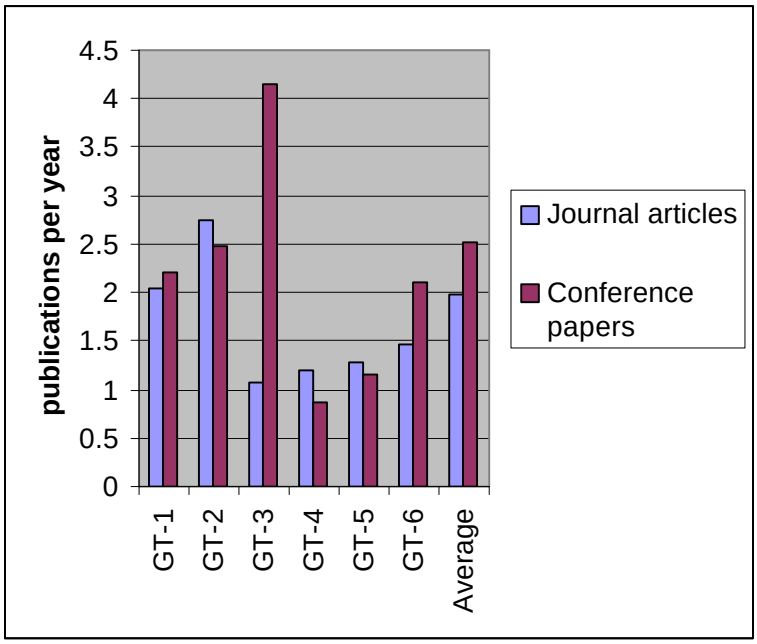
In the period 1996-2002 ICRISAT scientific staff produced a total output of 2241 separate documents. Both peer reviewed scientific journal articles (694) and conference/workshop papers (727) appear to be standard outlets for research results. After declining between 1996 and 1999, the number of publications increased significantly (Figure 3.1). This indicates that the current staff of ICRISAT has shown an increase in productivity in the second half of the review period, as far as scientific publications are concerned.

Figure 3.1 - Annual number of publications at ICRISAT, 1996 – 2002



For the staff working at ICRISAT in 2002 the average output was 2.0 journal articles and 2.5 conference papers authored per scientist per year. There was substantial variation in average number of publications per year per scientist, ranging from 0.14 to 7.43 for journal articles, and 0.4 to 14.0 for conference papers (for staff that had spent at least 2 years at ICRISAT). For journal articles, the averages for GT1 and GT2 scientists are above the mean, while those for the other GTs were significantly less than the mean (Figure 3.2).

Figure 3.2 - Average publications per scientist by Global Themes, 1996 -2202



The numbers for refereed journal articles are similar to those for ICARDA in the 1994-1998 period (germplasm enhancement - 2.6, production systems – 1.6, INRM – 0.5, and social sciences 0.4). They substantially exceed figures reported in the 2001 5th External Programme and Management Review of IITA (crop improvement - 1.6, INRM <1, socioeconomics <0.3). Likewise, at ICRAF all internationally recruited scientists and postdocs produced an average of 1.64 published items of *all types* in the period 1993-1997.

At the request of the Panel, ICRISAT analyzed the citation of its journal publications using the ISI (Institute for Scientific Information) Essential Science Indicators. About half of all the journal articles published by ICRISAT are in journals (137) that either do not have an impact factor (IF),[2] or are not covered by the ISI database (too recently established, local journals etc.). This suggests that ICRISAT scientists are either targeting poorer quality work towards such outlets, as they assume they cannot get them published in the premier league of journals, or they are targeting such journals to ensure that their information reaches a preferred intended audience other than that of scientists who have easy access to comprehensively stocked libraries. ICRISAT management believes that the latter is the more convincing rationale and give the example of The African Crop Science Society Journal (15 entries in the data base) which has no impact factor attributed to it, yet ICRISAT scientists use such outlets because they reach many NARS collaborators and others in sub-Saharan Africa whereas papers in the premier league journals may not do so.

Of the journals that have an impact factor in the ISI database just over two thirds of ICRISAT articles were published in 79 journals with impact factors ranging from 0.1-1.0. These included, most popularly, papers in Crop Science (IF 0.69), in the Journal of Agricultural Science, Cambridge (IF 0.67) and in Euphytica (IF 0.62), which are highly respected journals. At the "highest end of the spectrum" about one third of the articles published in IF journals had impact factors ranging from 1.02 to 7.25. Popular journals in this category were Theoretical and Applied Genetics (IF 2.36), Plant and Soil (IF 1.22), Field Crops Research (IF 1.07) and Plant Disease (IF 1.02).

In terms of numbers of citations per paper there is also a big variability. Many papers received no citations in other ISI covered journals. However, the top two ICRISAT papers with 94 and 32 citations respectively are very creditable (substantially higher than the top publications at two other recently reviewed CGIAR Centres). It should be noted that these two papers are of importance to agriculture well beyond the SAT regions and have thus reached a scientific public which would otherwise be less interested in quoting ICRISAT mainstream publications.

The Panel concurs with management that the analysis of ICRISAT's published output suggests the ICRISAT scientific community, in general, is reasonably productive and an adequate proportion of its work (journal articles in journals with adequate IF and books and book chapters from reputable publishers) has been deemed of acceptable standard by the global scientific community.

[2] The number of all current citations to source items published in a journal over the previous two years and dividing by the number of articles published in the journal during the same period --- a ratio between citations and recent citable items published

3.3 Genetic Resources, Cultivars and NRM Products

3.3.1 Genetic resource and cultivars

The quality of ICRISATs research on genetic resources is judged as being very high since the last EPMR. The last EPMR considered this to be ICRISAT's greatest success (their page xiii). The many accessions of the ICRISAT-mandate crop species in the gene bank are valued by the world-wide scientific community in that many seed samples have been requested and distributed to scientists in many countries. The gene bank is reasonably secure in that a majority of the accessions have been placed in long-term storage. Much germplasm has been extensively characterized by ICRISAT, and use of the main collections has been facilitated by establishing core and mini-core collections. The ICRISAT sub-Panel Report in March, 2000 of the Systemwide Review of Plant Breeding Methodologies in the CGIAR made the following assessment (their page vii). "The ICRISAT Genetic Resources programme continues to ably undertake its charge for collection, preservation, and management of germplasm. The recent shift in its major efforts from collection to pointed rescue, analysis, and description of diversity in its crop germplasm is positive and timely. Research initiated in establishing core collections, genomic analysis of diversity, screening, characterization, and enhancement of wild relatives for important and rare agronomic traits, studies on assessment of farmer management of genetic resources will all greatly enhance breeding efforts of the mandate crops everywhere." The EPR Panel agrees with this assessment, except to note that much more has been achieved in several of the areas since the assessment of the sub-Panel in March, 2000, for example the work on establishing the core collections has been completed. Also, the assessment of farmer management of genetic resources appears to have been transferred to other research units of ICRISAT, which appears to be appropriate, and was implicitly recommended by the Sub-Panel (their section 7.6 on page 32).

The Sub-Panel claimed (their page vi) that "Plant Breeding at ICRISAT has been the strength of the Institute in the past. A great deal of the global contribution that the institute has made is due to its plant breeding efforts." The EPR Panel feels that this also is valid for the last decade. ICRISAT-bred germplasm is valued as indicated by the extensive use of ICRISAT parental lines in developing hybrid varieties of pearl millet and sorghum in India, and the private sector financial support for the sorghum and pearl millet breeding programmes as was described in section 2.2. The quality of ICRISAT's cultivars is judged as being very high. As was pointed out in section 2.1 on Centre-wide recognition, ICRISAT received King Baudouin Awards in 1998 and 2002, principally for the pigeonpea and chickpea cultivars that it developed. Additional information on the quality of the cultivars developed by ICRISAT for all of their mandate crops, as judged by the extent of their adoption by farmers and their economic impacts, is presented in section 2.2 on achievements and impact in crop improvement. It is noteworthy, that in recent years several scientists working in the pearl millet, groundnut, sorghum, pigeonpea and chickpea teams have received major personal scientific awards that testify to the quality and importance of their research on crop improvement.

International public goods are also generated by the biotechnology programme (GT1 and its forerunner, GREP-P5) that have substantial value for use by public and private sector scientists and consumers. Notable IPG's are the following: (1) various intermediate products of interspecific crosses between cultivars and wild species, which have provided breeders with useful traits to develop hybrids in pigeonpea and disease-resistant cultivars of groundnut

and chickpea; (2) applied genomic technologies (maps, markers, mapping populations, pre-breeding lines, database) and methods (MAS for disease resistance) developed in pearl millet, sorghum, chickpea and groundnut; (3) breakthroughs in regeneration and transformation technologies (protocols, transgenic lines) that have opened-up opportunities for developing transgenic products of ICRISAT's mandate pulse crops; and (4) an ELISA assay developed for detecting aflatoxin that has the potential to solve major problems relating to the occurrence of this damaging toxin in human and livestock food and feed chains.

3.3.2 NRM products

The quality and extent of international public goods developed by ICRISAT in natural resource management was not clear to the EPR Panel (refer to section 2.3 for a discussion of the difficulties of assessing the achievements and impact in NRM since the last EPMR). However, the various IPM and IDM technologies developed for the grain legume crops appear to be of high quality and are being adopted by many farmers.

3.4 Databases

Socioeconomics database. A number of ICRISAT databases are in the public domain, and can be ordered online at the ICRISAT web site. They include data from Village level studies (VLS), District level studies, and Research Evaluation and Impact Assessment (REIA).

ICRISAT Economics Programme initiated VLS at six locations in Andhra Pradesh and Maharashtra states in India in May 1975. They were extended to Gujarat in 1980 and Madhya Pradesh in 1981 in India and few villages in Burkina Faso and Niger in Africa. Data collection ended in 1985. Only the Indian data set is available in the database. The major objective of Village Level Studies (VLS) was to understand the socioeconomic, agrobiological, and institutional constraints to agricultural development in the semi-arid tropical (SAT) area.

The District level database contains district level data for 384 districts in 13 States in India from 1966 to 1994, containing statistics on area and production under major crops, etc.

The REIA database contains information on - research themes, core and complementary funding, ICRISAT research output, constraints limiting adoption and diffusion of technologies, and gender analysis of groundnut production technology adoption and diffusion.

The databases are in high demand. Over the last 3 years 98 requests were filed, with the vast majority (56%) naturally from India, followed by the US (19%) and Europe (16%). The Panel commends ICRISAT for making the databases available on line. They are of good quality, and the VLS data has proved to be one of ICRISAT's most valuable contributions to the knowledge on the socioeconomics of the SAT in India. While the Burkina Faso VLS data is apparently available on request for those that know about it, the Panel is disappointed to note that ICRISAT has not made similar investments in putting the African VLS database in the public domain as has been done for the Indian database.

Genetic resources and biotechnology databases. ICRISAT'S genetic resources database contains information on the germplasm holdings of ICRISAT's mandate crops: sorghum (35000 accessions), pearl millet (20500 accessions), chickpea (16990 accessions), pigeonpea (12550 accessions) and groundnut (14000 accessions), as well as an additional collection of small millets (7000 accessions). The database contains information on passport data (23 fields), agronomic-morphological characterization data (14-21 traits depending on the crop) and evaluation data on resistance to biotic/abiotic stress as well as quality parameters. On average, 93.75% of the total collection has been characterized over the last 25 years making the database the largest and one of the most comprehensive databases of these SAT crops. The Systemwide Information Network for Genetic Resources (SINGER) has recognized that ICRISAT's genetic resources database is one of the best among the CGIAR Centres. Although no data exists on the number of visitors accessing the sites, it is perceived that the database has been accessed extensively based on the number of on-line seed requests received by the Genetic Resources Unit. This database can be accessed through the intranet and internet websites of ICRISAT and SINGER. It has various links to other related sites. However, the user must be knowledgeable enough to navigate the web to be able to access the particular information needed.

The genomic databases of the Applied Genomics Laboratory (AGL) can be grouped into three categories. These are:

- Databases of ICRISAT-generated materials (13,936 total records) – cloned SSRs from groundnut and ESTs from chickpea; sorghum DNA marker-based maps (comparison of 14 maps); sorghum and rice synteny

- Searchable sequence databases developed from public domain databases (1,062,238 total records) – unique subsets of SSR containing ESTs (36, 503 records) from sorghum, *Medicago* and soybean have been identified for microsatellite marker development.

- Searchable databases of other related legumes and cereals (8,429 total) – unique subsets of public domain full sequence SSRs and annotated ESTs of rice, soybean, *Medicago*, cowpea, pea, *Vicia faba*, lentil, lupin, stylos, *Phaseolus* bean and mungbean)

The Panel commends ICRISAT for developing in such a short period, a relatively large and informative database of these less researched mandate crops. The sizes of these databases will increase further once the data from ICRISAT generated markers (SSRs from groundnut and ESTs from chickpea) are completed. These genomic databases could be characterized as original, unique, and of immense value considering the manner in which these were constructed. Data in the genomics databases is only available on the intranet until associated journal publications or theses are accepted whereupon it is internet enabled. A small proportion of marker data is proprietary and will only ever be available to ICRISAT scientists and collaborators under its staff confidentiality clause. This internal policy of restricted access has been lamented by some of the NARS interviewed by the Panel. Although the Panel is very pleased to note that ICRISAT has initiated to place some of the databases in the public domain, efforts must be exerted to make these databases available to the larger community as soon as possible if they are truly to be considered as IPGs.

3.5 Partnerships

As stated in the Foreword to the current Vision and Strategy document, ICRISAT's goal is to harness the power of technology for development, food security, poverty alleviation and environmental protection, targeted at poor rural families in general, and women in particular; targeted at specific goals and *implemented through genuine partnerships*. A CCER on the topic was commissioned in 1999, and gave guidance for improving the Centre's activities. In a recent survey among scientists, partnership building was ranked 10th among the 97 output items clearly indicating the importance ICRISAT assigns to the activity.

3.5.1 Host Country Linkages

Host country linkages of any CGIAR Centre always warrant special consideration. India has the largest share of ICRISAT's target clientele, the poor people of the SAT. It has also a very strong NARS and huge resources including human and financial capital. The last EPMR pointed out that the fundamental issue affecting ICRISAT's relationships in India is the perceived degree of overlap in their programmes. It suggested that ICRISAT should resolve this problem besetting the relationship between ICRISAT and the ICAR system, the institution primarily responsible for agricultural research activities in India. Information available to the Panel suggests that relations at the scientific and administrative levels between ICRISAT and the ICAR system have dramatically improved since the last EPMR. In addition to its long standing collaboration with ICAR, linkages have expanded to include universities, other public institutions and private sector and foundations in India. Thus enhanced host country ties were achieved through new partnership models, which included the incubator and biotechnology research parks, active participation in bilateral projects and joint R&D project planning and implementation. The Panel judged these developments as very positive and vital to ICRISAT's continued success in its delivery of its global products and services. The Panel commends ICRISAT for going out of its way not only to resolve the problem but for its efforts to enhance its relationships in India.

3.5.2 Linkages in Asia and Africa

Partnership building activities at ICRISAT cover a wide range. In Asia a formal approach to collaboration and partnership-based research was initiated in the mid-eighties with the formation of regional networks. Based on feedback from Asian NARS who wanted a single-window for all partnership–based research with ICRISAT, the Cereals and Legumes Asia Network (CLAN) was formed in 1992. It has established mechanisms for partnership among the 13 network member countries, and between ICRISAT and member country NARS. Consequently, all research collaboration, both bilateral and multilateral, employs the CLAN umbrella. Activities involved regional coordination of R&D activities, priority setting for ICRISAT research, building of linkages with the regional Asia-Pacific Association of Agricultural Research Institutions (APAARI), as well as activities along the strategic-basic-applied-adaptive research continuum.

In Africa partnership arrangements range from posting of ICRISAT scientists into NARS to enhance partnership and collaboration, and other bi-lateral, multi-lateral, joint research activities through special projects involving the private sector, NGOs and farmer organizations. In addition, there have been ecoregional and Systemwide initiatives, capacity building, networking, active participation in NARS Programme reviews and the development

of medium term plans, participation of NARS in ICRISAT regional planning meetings, attendance at NARS planning meetings, research reviews and consultancies by ICRISAT or NARS in their domains of comparative advantage, as well as a visiting scientist scheme. ICRISAT has also established a number of regional hubs to address the research needs of the Sub Regional Organizations (SROs), has contributed to their priority setting, and hosts a number of SRO networks.

The Panel observed that partnerships arrangements now include those aimed at enhancing the capacity of countries to better exploit the opportunities provided by the IPGs produced by ICRISAT to produce National Public Goods (e.g., the posting of ICRISAT scientists within NARS, joint planning of NARS research activities, in service training of NARS scientists, etc.) as well as those aimed at contributing more directly to the production of IPGs (joint planning of ICRISAT regional research activities, participation of consortia of NARS in regional research activities, etc.). There appears to have been a shift in recent times from the former to the later types of partnerships, particularly in Asia where there is more and more collaboration at the strategic-basic end of the research continuum.

The Panel commends ICRISAT for the vigor with which it has pursued the development` of appropriate partnerships with the NARS and other stakeholders. During interviews and contacts with ICRISAT's collaborators the Panel observed that there was general satisfaction among donors and other international partners with the degree and quality of ICRISAT's partnership arrangements. However, some of the NARS expressed the need for more involvement in the preparation of ICRISAT's regional research plans, and in the joint preparation and submission of projects to donors for funding. The Indian NARS expressed to the Panel its readiness to strengthen its national and regional partnership with ICRISAT. It was evident to the Panel that ICRISAT scientists are making efforts to address this long-standing criticism of IARCs by their NARS partners. However, this is an issue that management needs to keep constantly under review.

3.5.3 Inter-Centre and Systemwide Partnerships

ICRISAT is involved in a large number of collaborative projects with other IARCs and Advanced Research Institutions. Memoranda of Understanding exist with IFPRI, IWMI, ISNAR, ICARDA, IFPRI, ILRI, CIAT, INIBAP, TSBF, IITA, ICRAF, IFDC and over 30 ARIs. The Centre is also engaged in a number of CGIAR Systemwide Programmes (Desert Margins Initiative of which it is the convening Centre, Systemwide Genetic Resources programme, CGIAR consortium for collaboration on agricultural research and development in Central Asia, etc.) During its review The Panel was not made aware of any major issues relating to partnerships with other Centres. ICRISAT pays adequate attention to nurturing its Inter-Centre and Systemwide partnerships.

3.5.4 Training

Training has been ICRISAT's strength in the past. On-site training, focused largely on commodity-related activities, has been its main mode of delivery. This had led to limited access of African partners to training in India, primarily because of the high travel costs involved. In addition, the NARS-evolving needs especially in Asia, led to a demand for methodology- rather than crop-based training. With dwindling resources and changing demands, which were highlighted in the 1999 CCER Panel report, ICRISAT responded by undertaking a paradigm shift on its training strategy. From generic mass on-site training, its

training programme shifted into three modes: scholarly studies, joint project attachments and specialized training courses. Scholarly studies provided training for candidates of MSc., Ph.D., or equivalent degrees by carrying out their thesis research at an ICRISAT location while completing their course work at a recognized university, either in a developing or developed country. Joint project attachment, is a non-degree oriented training, which likewise provides a learn-by-doing experience while contributing to the shared ICRISAT/NARS research project agenda. Specialized courses are focused on providing training in cutting-edge technologies and methodologies as well as other contemporary topics. The training modes are very much in agreement with the results of the recent survey conducted among ICRISAT scientists, which viewed training as one of the four categories of outputs used to assess science quality. The Institute-wide average responses included in the top-ten list of the most important training activities were the following: higher degree students (Rank 3), training workshops (Rank 5), young scientist in-house mentoring (Rank 6) and training courses (Rank 10). Other students and non-degree training were ranked as the least important.

The EPR Panel notes that the paradigm shift in training strategy gave ICRISAT the flexibility to tailor the training options based on demand/need. It provided the training unit as well with an innovative solution to the funding constraints by sourcing non-traditional partnerships. The scholarly studies and joint project attachments have led to the generation of international public goods of high quality and usefulness to the scientific community. With the new training modes, ICRISAT is now better positioned to serve a wider range of needs within the upstream-downstream continuum to a larger number of partners.

It is clear to the Panel that the staff and management of the training unit (renamed Learning Systems) are exerting all efforts to fulfill its functions to disseminate information and technologies generated by ICRISAT's research programmes. The Panel also notes that the training unit has taken advantage of the IT environment in Patancheru, and collaborated with Information Systems to implement a pilot ICT-enabled distance learning module, which could offer tremendous opportunities for maximizing training and information dissemination. However, the Panel cautions the management and its partners to re-examine more rigorously the "Virtual University for the SAT" initiative. This concern is discussed further in section 6. 4.

3.5.5 Staff and Staff Assessment

The staffing of ICRISAT has seen major changes over the review period, greatly weakening the centre. According to "ICRISAT 1996-2002 at a glance", international recruited staff went from 80 in 1996 to 38 in 2002 and postdocs, research fellows, visiting scientists and special project scientists went from 36 to 15 in 2001 to return to 30 in 2002. The loss was compensated in part by reclassifying/upgrading and hiring nationally recruited research staff (SMG/RRS) largely in India, which went from 6 in 1996 to 59 in 1997 and tapered off to 45 in 2002. At the same time nationally recruited support staff was nearly halved to 858 in 2002. A primary cause of this trend has undoubtedly been the reduced income which stood at 29 million dollars in 1996 and at around 20 million in 2002. Of that, unrestricted core nearly halved (56%) to 9 million, with 3.6 million in globally restricted and 7.4 million in restricted grants making up the rest. The consequence for the Asian – Africa staffing balance has been that out of 122 scientists (IRS and RRS), postdocs, research fellows and special project scientists in 1996, 54 were in Africa (44%) whereas in 2002 this had dropped to 38 of 113 or 33%. The situation with regard to scientific support is worse, with only 42% of the 1996

support staff remaining in Africa in 2002. The African continent captures around 20-25% of the support staff (scientific and administrative).

Under conditions of such duress, the possibilities of retaining high quality scientists are limited. The Panel has met many of the scientists and is impressed with their dedication to the centre, but is equally concerned about the effects on morale of job insecurity and inequity in resource allocation amongst regions.

By its own admission in the EPR Briefing Document (Assessment of Science Quality at ICRISAT), "methods for assessing the quality of scientific outputs at the Centre were rather crude". In an environment of retrenchment this has become a concern of the scientists of the Centre (p. 4). The Panel is pleased to note that management is now increasingly aware of the need for fair appraisal of the entire range of outputs, and recognizes that these outputs might differ among Global Themes. As a first step to remedy the situation the Centre did an analysis of the scientists' perception of the relative ranking of outputs to the institute. Overall, the science community of the Centre still values the written scientific outputs, closely followed by new techniques and varieties, fund raising and partnership building. It also showed a low esteem for posters, press releases, software development and GIS products, administrative duties etc. GT differences were confirmed. Management also needs to take into account the requirements of donors and other stakeholders.

In evaluating staff quality, the Panel also took account of the judgment of outside institutions as expressed through awards and honours for exceptional research work and services to science, agriculture and society; invited lectures and keynote addresses; memberships of national and international committees; honorary Professorships and fellowships; and M.Sc. and Ph.D. students supervised.

Twenty-nine professional staff received 65 awards and honours during the review period. Twenty-seven staff sat on 77 external panels and committees, which included advisory panels of international initiatives, national steering committees and international organizing committees of important conferences. Information on invited lectures show that 31 staff delivered 113 invited and keynote addresses. In addition, staff members supervised 98 M.Sc. and Ph.D. students. Several staff hold honorary professorships and fellowships in Universities in India and abroad.

The Panel considers that the above statistics show that ICRISAT's research is being recognized, and translated into invitations that would influence and contribute to other research agendas.

Overall, the Panel considers the quality of the Centre staff to be at par with those of sister institutes. However ICRISAT's scientific staff strength and operational resources are inadequate, given the research agenda at hand.

CHAPTER 4 - THE VISION AND STRATEGY

4.1 ICRISAT's Vision and Strategy

4.1.1 History and Current Situation

The fourth EPMR of ICRISAT conducted in 1996 emphasized the need for a strategic realignment of ICRISAT by adopting a new paradigm based on the strategic partnership model. Global germplasm research was to be located at ICRISAT's headquarters in India, while natural resources management research was to be concentrated in Africa. In response to the EPMR recommendations, the newly appointed Director General of ICRISAT in 1997 mapped out a new vision for ICRISAT with programmatic implementation for ICRISAT research. The vision was focused on the Centre's stature within the mandate region, its mission to increase food security, reduce poverty, and protect the environment through partnership-based (NARS) international agricultural research. A streamlined agenda and efficiency gains were sought by consolidating the former 12 Research Projects (operating under 7 disciplinary research divisions) into three Programmes, namely: the Genetic Resources and Enhancement Programme, the Natural Resources Management Programme, and the Socioeconomics and Policy Programme. Subsequently, a fourth programme was added in 2000 - The Information Resource Management Programme. The Vision statement spells out how resources are expected to be allocated over the various programmes and regions.

In genetic resources, ICRISAT adopted a new paradigm in strategic germplasm research, using "new science" to exploit the genetic endowment in its gene bank more systematically and fully. For the first time in its history, ICRISAT's genetic improvement effort was organized according to major topical thrusts (e.g., biotechnology, targeted crop improvement such as hybrid parents research), rather than by mandate crops. Land degradation and water use were proposed to be the two major thrusts of ICRISAT's NRM work. Work on technology components was de-emphasized but complemented with research on NRM problems faced at the watershed and agro-ecology levels. The main aim was to identify sustainable uses of the natural resource base that could help reduce poverty, promote food security and prevent environmental degradation. In the initial years following the EPMR, the emphasis of NRM work shifted from Asia to Africa but much of this was eroded over the past few years due to declining unrestricted resources (see section 5.3).

In the field of socioeconomic research, the emphasis was on the analysis of the potential of SAT agriculture, alternative investment strategies, input and product markets and policies. ICRISAT's research work increasingly became integrated with partners' needs and priorities. Inspired by the EPMR suggestion, the social science team of ICRISAT initiated the SAT Futures initiative, especially in scanning the changing global and agricultural research environment, and the consequences for the ICRISAT agenda.

The future trends and scenarios in agriculture in the SAT of the developing world (Ryan and Spencer 2001) were used as a basis for planning a new vision and strategy for the institute by the new Director General. For the Centres of the CGIAR, the latitude in choosing a vision is somewhat restricted, as the framework provided by the Consultative Group should not be violated. ICRISAT has properly recognized this and claims to be guided by the seven new planks of the CGIAR that are derived from its vision of a *food secure world for all.* The

WEHAB (Water, Energy, Health, Agriculture and Biodiversity) principle underlies the strategy for 2000-2010. Key entry points for ICRISAT's strategic research objectives include a) food, through enhancement of cereal grains like sorghum, millets and others; b) nutrition, through legumes – chickpea, pigeonpea and groundnut; c) health, through biofortification and removal of toxic food contaminants; and d) livelihoods through diversification of income generation, which leads ICRISAT beyond its mandate crops and involves both agriculture and non-agriculture. ICRISAT's vision is open-ended and is the *improved well-being of the poor of the semi-arid tropics,* which it hopes to accomplish through '*agricultural research for impact'*. The visions will serve at first until 2010, but may actually need to be extended far beyond this date.

The ICRISAT mission statement elaborates on the vision in that it promises to pursue the vision while insuring the protection of the environment and in partnership with many stakeholders. The promise of the mission statement to conduct 'Science with a human face' is not further elucidated. The Centre's mission focuses on the SAT's poor and aims to improve their livelihood by improving: (1) production and nutrition and affordability of the mandate crops; (2) diversity of use of staples; (3) sustainable use and management of natural resources; (4) techniques and tools to manage risk; (5) diversity of income generation; and (6) delivery systems to key clients.

The strategy of ICRISAT is to accomplish its mission through problem-based, impact-driven regional and local projects that are subsumed in six Global Research Themes (GTs). These projects are to reflect specific regional strategic priorities (SA and SSA) and should be scientifically excellent and generate impact by targeting opportunities to help the poor. The great emphasis is on partnership "*with functional linkages between research, extension, farmers and markets*". Priority setting and impact assessment are claimed to be part of the strategy.

The six global themes as first defined in the MTP 2003-2005 are:

GT1 - Harnessing biotechnology for the poor
GT2 - Crop improvement management and utilization for food security and health
GT3 - Water, soil and agro-biodiversity management for ecosystem health
GT4 - Sustainable seed supply systems for productivity
GT5 - Enhancing crop-livestock productivity and systems diversification
GT6 - SAT futures and development pathways.

They are described in a brief fashion in the strategy paper with a more extensive retrospective section on impact highlights for each GT. More details are found in the 2003-2005 MTP. A Systemwide initiative on the Desert Margins Programme (DMP) is managed independently. We reflect on the GTs and the DMP in more detail in chapter 5.

The GTs were derived from the SAT Futures exercise and the resulting report and are consistent with the vision, mission and strategy. Some new areas of business are assembled under GT4 and GT5. However, the GTs are essentially a reorganization of the previously existing 10 Global Projects into Global themes in such a way that they more effectively address the 4 Global Impact Target Areas defined by ICRISAT; these are:

Coping with Crises
Generating Enterprise Profitability and Sustainability
Nourishing the Well-being of Families and Businesses
Building Partner Power

The aim is to integrate and consolidate related areas of work for more efficient research implementation, management and reporting. For each GT the Vision and Strategy document provides a set of objectives and deliverables but no time lines. Some differentiation in approach and deliverables between SA and SSA is provided in these descriptions.

4.1.2 Assessment

The Panel notes that ICRISAT's mandated domain of operation is the semi-arid tropical region with a short growing season, recurrent droughts, vulnerable soils, and limited run-off. This is, no doubt, one of the most challenging environments for the pursuit of this mission. The lack of any quantitative goals in its vision may leave the reader with the impression that ICRISAT has outfitted itself with an open-ended agenda. Maybe it is not wise to make promises that are quantitative and can or will not be met, but the absence of any concrete targets or milestones in the Vision and Mission statements that will guide ICRISAT in the coming years make it more difficult to measure accomplishments of the Centre.

The Panel also notes that, although the Strategy may serve as a broad statement of principle, it lacks specificity. Particularly, it lacks the context of the grand challenges that shape ICRISAT's agenda. For the benefit of the EPR a document on "Major issues confronting ICRISAT's research agenda for 2003 and beyond" was prepared. In this document the Centre defines 4 Global Impact Target Areas and elaborates on the issues it wishes to address, but a further consultation process will be needed to bring those down to a set of reachable goals. Though the Vision statement acknowledges the differences between SA and SSA (p.3) it makes little effort to analyse these regions in order to differentiate the major challenges and resulting strategies. The issues paper is also rather mute on this issue.

The debate of where ICRISAT's involvement in the partnership continuum should stop and be largely devolved to NARS and NGO's is alive and well in the Centre, but not addressed in the Vision and Strategy statement. Linking with a broad range of change agents from SROs down to the farmer that are proposed as partners carries in it the danger of addressing issues that will not lead to the generation of IPGs. Particularly in this respect the two regions may have to be approached differently. The new Impact Assessment Unit was established partly for this purpose and some of these issues may be addressed in the ongoing priority setting exercise.

The GTs are presently rather different in size. The document does not give an indication of what the Centre would consider an optimal mix in its portfolio to effectively address its mission in the SA and SSA region. For an outsider, donor or stakeholder, this guiding document for the (near) future of ICRISAT fails to clearly position the institute. It lacks a logical framework and fails to transmit a vision of where ICRISAT wishes to set its priorities and allocate its resources. It leaves the Institute open, within the broad terms of the strategy paper, to be steered by the donor community into areas where it will neither have a comparative advantage nor deliver IPGs. Some of these tendencies were already observed during the site visits by the Panel.

In October 2001 the Vision and Strategy document was adopted by the Board after it was discussed in the PC. However, it is not clear where the Centre is planning to place its core resources, neither between the GTs nor among the regions. Yet, apparently, the implementation of the new Vision and Strategy required a re-alignment of core competencies (Board minutes).

According to a document from a multi-Centre workshop on priority setting, named 'Planning in muddy waters', the process of priority setting by ICRISAT was all encompassing and participatory, involving key stakeholders such as ARO, NARS, policy makers and farmers involved in workshops, thus tapping a large, multi-disciplinary pool of expertise. The process has now been made into a GT (6) as SAT futures. The process claims …'to have analysed constraints in meeting the ICRISAT vision for the coming decades and …. the implications for R&D strategies and priorities for the SAT, and the roles for ICRISAT, NARS, NGO's and the private sector'… In fact, the process has yet to be concluded and the Panel only viewed a partially completed Logical Framework that eventually should emerge from this process.

It appears that the staff of the Centre is now fully participating in the strategizing process. Some delay was unavoidable due to the fact that the DDG research has changed during this process.

4.2 International Public Goods and Comparative Advantage

The main objective of the CGIAR is to help generate International Public Goods (IPGs) through research and related activities. IPGs have been defined as benefit providing utilities that are in principle available to everybody throughout the globe. Three types of benefits that are non-excludable (i.e., cannot be expropriated) and non-rival (i.e. consumption by some do not reduce amounts available to others) give rise to public goods – risk reduction, enhancing capacity, and direct provision of utility.[3] From the standpoint of an IARC like ICRISAT risk reduction benefits would cover elimination of the risk or reduction in the incidence of a plant disease. Enhancing capacity covers generation of knowledge and training, i.e. enhancing the capacity to use knowledge. Conservation of biodiversity and protection of the environment achieve direct provision of utility.

IPGs have a spatial range across borders and even continents, while National Public Goods (NPGs) are inherently national such that they are delivered at the national level, and a substantial proportion of the benefits accrues only at the national level. By their nature all ICRISAT GTs produce capacity enhancing benefits. GT2 and GT3 can produce risk reduction benefits, while GT1, GT2, GT5 and the DMP can directly provide utility. The actual activities that should be undertaken by ICRISAT in providing the benefits depend very much on its comparative advantage, an issue discussed below.

The stated vision of ICRISAT from now to 2010 is that "Although ICRISAT's focus is global, we have a particular emphasis on sub-Saharan Africa, where more than 300 million poor people live." (Introduction by the Director General to the document 'ICRISAT's Vision and Strategy to 2010'). The remainder of the vision document indicates that substantial research still will be conducted at Patancheru, India but that some of this research will be

[3] Morrisey, Oliver, Dirk Willem de Velde and Adrian Hewitt (2002) "Defining International Public Goods: Conceptual Issues." Overseas Development Institute, London. Draft of Chapter 2 in M. Ferroni and A. Mody (eds), *Strategies for International Public Good*s (Kluwer, forthcoming).

targeted to backstop research conducted in sub-Saharan Africa. The vision document does not discuss research by ICRISAT in the Americas and presumably little research activity is planned for this Continent as was the case in earlier years. The vision document points out that research will emphasize reducing poverty, hunger and malnutrition in the SAT regions of sub-Saharan Africa and South Asia.

The need for international intervention in agricultural research is different, however, for the African SAT than the Asian SAT for which India is the largest part and also has many poor people. Whereas development in Africa will be based on agriculture, India is rapidly industrializing and, providing the current trends persist, will be at a par with western countries in terms of GDP in a decade or so. Recently, India has started to assert itself as an equal partner with the West. Having the world's second largest agricultural research community, India should be increasingly seen as an equal partner and contributor to solving the agricultural production and natural resource problems of the SAT. In Africa, where infra-structure and development trends are lagging far behind, there are tremendous opportunities for International Agricultural Research Centres, such as ICRISAT, to assist the weak NARS by providing IPGs and building human capital, in order to reduce poverty, hunger and malnutrition. The Panel feels that ICRISAT has a strong comparative advantage and a wider scope for producing IPG's in sub-Saharan Africa than in South Asia.

ICRISAT proposes to continue to place major emphasis in research in the SAT on its mandate crops: sorghum, pearl millet, groundnut, chickpea and pigeonpea. These crops are staple food energy, protein and oil crops for many poor people in the SAT. Presumably, ICRISAT also plans to continue to exploit opportunities for improving crop production by its mandate crops in the more humid climatic zones where significant production of some of these crops does occur. ICRISAT has a comparative advantage for conducting plant breeding and agronomy for its mandate crops irrespective of where they are grown.

However, for ICRISAT to comprehensively pursue the improvement of cropping systems in major SAT regions of sub-Saharan Africa, it also needs to place some emphasis on other crop species, such as cowpea, as it has done in the past at the Sahelian Centre in Niger. The major crop species grown in the Sahel are pearl millet, groundnut and cowpea. When grown in rotation, cowpea can reduce infestations of various pests on the other crop species providing the cowpea cultivar that is used suppresses the reproduction of the pest. Clearly there is a need for close collaboration between ICRISAT and major cowpea breeding programmes, such as those of IITA, which has the CGIAR mandate for crop improvement research with cowpea.

An advantage of International Centres compared with developing-country national programmes with respect to applied and strategic agricultural research is that International Centres have a higher probability of developing IPGs. This is because they have the potential ability to recruit and retain excellent scientists, and provide them with the facilities and conditions needed for them to conduct effective high quality applied and strategic research. Another advantage of International Centres compared with national programmes and institutions in both technologically developed and developing countries is that International Centres have a clearer mandate for collecting and distributing germplasm on a world-wide scale. Following this mandate ICRISAT has developed the major international germplasm collections for its mandate crop species: pearl millet, sorghum, groundnut, pigeon pea, chickpea, and six small millets. A third advantage of International Centres is their access to

experimental sites in many contrasting ecological zones and sociocultural domains through either their off-campus centres or their partnerships with many national programmes.

The advantages above provide International Centres with a specific, major comparative advantage for conducting plant breeding to produce enhanced germplasm that is then used by national programmes to develop new varieties. The execution of plant breeding programmes benefits substantially from the ability to evaluate diverse germplasm in a broad range of environments that have contrasting biotic, physical and chemical conditions and stresses. The IPGs that can result from these efforts include germplasm with resistance to specific biotic, physical and chemical stresses and different product qualities, and more efficient breeding methods. However, for International Centres to make full use of these advantages they must be able to develop comprehensive plant breeding teams that access all of the necessary disciplinary expertise including: genetics, molecular biology, plant sciences, plant pathology and pest sciences, and in some cases soil sciences, food science, socioeconomics etc.

It is useful to consider where International Centres do not have a comparative advantage. They do not have a strong comparative advantage in location-specific varietal development, since, in the long term, national programmes and commercial companies have the potential to be much more effective in addressing local constraints and have more sustained efforts in varietal development and seed production and distribution. Consequently, in principle and in the long term, International Centres should promote the use of the enhanced germplasm they develop through partnerships with national programmes and commercial companies that breed varieties. However, in the short term, for places such as many countries in sub-Saharan Africa where national and commercial plant breeding programmes are not yet strong, International Centres do continue to have an important role in breeding crop varieties in collaboration with national programmes.

International Centres also do not have a comparative advantage with basic research that is pursued solely for the purpose of enhancing understanding, compared with research programmes in advanced institutions. Consequently, where specific up-stream research is viewed as potentially important for complementing major applied research thrusts, International Centres should pursue this research through partnerships with advanced laboratories that have a greater comparative advantage for conducting more basic research. In the main, ICRISAT has pursued appropriate strategies of this type since the last EPMR.

ICRISAT has a mandate for conducting strategic and applied research to benefit poor people in the semi-arid tropics, but it should not be considered as having a comparative advantage in all of this complex subject area. ICRISAT has developed considerable expertise over the years in research to develop improved rainfed cropping systems for the SAT that include ICRISAT-mandate crop species, and this strongly complements the work on germplasm enhancement and varietal development. This research exploits the synergies that can occur when combining new varieties with complementary cropping systems. ICRISAT research on seed systems can facilitate the extension of varieties and improved cropping systems to farmers. ICRISAT also has developed considerable expertise on soil and plant water and nutrient relations that complements its work on germplasm enhancement and varietal development, and addresses key constraints to the development of improved cropping systems for the SAT. ICRISAT’s work on integrated pest and disease management complements its efforts to develop germplasm with multiple resistance to pests and diseases, and makes possible a more comprehensive approach to the development of improved

cropping systems that also enhance the environment and public health. Another advantage of more comprehensive approaches is that transfer of technologies to national programmes and farmers can become more effective once near-complete improved systems have been developed.

Through earlier research, ICRISAT has gained a comparative advantage in working on larger-scale systems, such as watersheds, and in analyzing the agro-ecological variability and characteristics of the various SAT environments. This research has led to improved understanding of SAT agro-ecological zones and niches where current and potential new varieties of its mandate crops could be successful, and the development of improved methods for managing agro-ecosystems in the SAT. ICRISAT has also gained comparative advantage in the generation and use of socioeconomic data for tracking the development of rural communities in the SAT, the VLS database, as well as in the evaluation and design of new seed systems for the SAT.

A recent initiative by ICRISAT to move more strongly in research for developing improved, integrated cropping and livestock systems for the SAT has been justified by two sets of factors: 1) Forage and feed links occur between livestock, cereal and grain legume products, and there are soil-fertility links with livestock manure. 2) These integrated systems could make major contributions to NRM and improvement of livelihoods in the SAT. Conceivably, ICRISAT could develop a substantial comparative advantage in the improvement of integrated cropping and livestock systems for the SAT that rely on rainfall, providing it maintains strong linkages with the International Livestock Research Institute and other research Centres.

Some other research areas for the SAT have recently been introduced into the ICRISAT research agenda e.g., irrigated market gardens, system diversification using tree and vegetable crops, and monitoring and preservation of native species, where there is a potential for producing IPGs, but in which other institutes have strong programmes, although these might not be in the SAT. ICRISAT needs to carefully assess its comparative advantage in these areas, and must build strong partnerships and focus on strategic research. ICRISAT will have difficulty in conducting and sustaining research of high quality in areas where it does not have a clear comparative advantage.

The Panel’s overall conclusions are that the comparative advantages of ICRISAT in research are in the following areas. 1) Developing, maintaining, and enhancing the use of germplasm collections of its mandate crop species. 2) Breeding enhanced germplasm and, in the short term improved varieties in some cases, and developing improved breeding methods for its mandate crop species. 3) Developing improved rainfed, cropping and integrated cropping and livestock systems for the SAT in sub-Saharan Africa that include its mandate crop species and consideration of larger-scale aspects of NRM, such as enhanced watershed and agro-ecosystem management. 4) Analysis of institutions, policy, commercialization of seed systems, and the marketing of ICRISAT mandate crops. 5) Generating data and analysis of the evolution of rural communities in the SAT.

CHAPTER 5 - THE GLOBAL THEMES

5.1 GT1 - Harnessing Biotechnology for the Poor

Global Theme 1 (GT1) was formulated to harness biotechnological approaches to complement and further strengthen ICRISAT's crop improvement efforts. Biotechnology research at ICRISAT started in 1996 under the Genetic Enhancement Division. At the time of the last EPMR, ICRISAT had limited in-house capacity to carry out modern biotechnology research. After the streamlining and re-organization of ICRISAT in 1997, the activities in wide crossing and linkage mapping were elevated into two projects (G4 and G5), which were consolidated further into a single project, G2 (New tools: adapt and apply new science methods to SAT crops improvement). In 2000, the Genomics Project was formally created. Significant investments on human and capital resources were made including the hiring of the Head of the Applied Genomics Laboratory (AGL). Centralized genomics and transgenics laboratories were established. More recently, an IP office and the Biosafety Committee were created. In 2001, Biotechnology was elevated into a project (P5) and finally reassigned as GT1 when ICRISAT shifted from a programmatic to a thematic structure in 2002.

Throughout the evolution of the biotechnology programme at ICRISAT, its stated goal, purposes and objectives have remained fundamentally the same. GT1 has remained committed to develop: (a) agronomically elite pre-breeding and transgenic lines of ICRISAT mandate crops with drought, pest and disease resistance and better agronomic traits, including food, feed and fodder quality; (b) well characterized genetic stocks for crop improvement and basic scientific research; and (c) robust and cost effective biotechnological tools for molecular breeding, and detection of pathogens, toxins, transgenic contamination and purity of seed production systems.

The current structure of the GT1 has adopted a product-based framework that enables projects to apply any combination of techniques to achieve their goals. GT1's research strength and focus have remained primarily in applied genomics, specifically markers and MAS. ICRISAT's earlier ambivalent position on transgenic research has been resolved by recent successes in the development of transformation protocols and transgenic products as well as the changing external environment (financial, policy, political). Transgenic research at ICRISAT is focused mainly on development of transgenic legumes with disease or pest resistance traits for both Asia and Africa. Within the applied genomics area, the long-term focus has shifted from simple traits like disease resistance towards more complex traits such as components of drought resistance, pest resistance, and food and fodder yield. Regarding specific problem/crop combinations, the focus has changed quite frequently, with the changes largely driven by the availability of external funds. Hence, in the rolling MTPs from 1998 to 2005, some milestones appear, disappear or re-appear. A similar situation was also observed in the case of wide crosses and diagnostics research.

Markers, maps, cloned genes, mapping populations, and databases as well as pre-breeding lines and transgenics for targeted traits will continue to be generated. An Agri-Business Incubator and an Agri-Biotech Science Park initiative have been launched to demonstrate ICRISAT's serious and long-term commitment to applying modern biotechnology including transgenic technology for targeted interventions in its mandate crops.

All activities under GT1 are being carried out in ICRISAT-Asia. Opportunities to decentralize to sub-Saharan Africa were initiated in 2002, by moving an internationally recruited staff from Asia to East Africa, currently hosted at ILRI, to serve both ICRISAT and IITA on a cost-shared basis. Research and development, starting with capacity building activities have been initiated for the region. A similar joint position has been established with CIRAD in Mali. In India, priority will be given to protocol, technology, and biosafety development activities plus applications for Asia in collaboration with NARS and the private sector.

5.1.1 Critical Mass

In order to implement the various activities under GT1, a total of 29 senior scientists, including IRS, special project scientists, post doctoral fellows, and scientific officers with various expertise contribute a total time equivalent of 13.7 person years (PY). Each scientist contributes between 0.5 to 1.0 PY. The total time allocated to biotechnology in Africa is 0.7 PY divided between a molecular biologist (0.5 PY) and an economist (0.2 PY). The largest proportion (7.2 PY or 66%) of the total scientist's time is allocated in applied genomics, followed by bioinformatics. The Head of AGL/GT1 team leader contributes 50% of his time to leading the legume genomics group. There is a dedicated cereal genomics scientist but only one IRS providing scientific expertise for transgenic activities in all five crops.

5.1.2 Assessment

Biotechnology at ICRISAT. The Panel commends ICRISAT for its determined and unstinting efforts to bring to bear "new science and tools" for conservation and improvement of its mandate crops. The Panel applauds the staff of GT1 for its ground-breaking achievements in the development of transformation systems and transgenic products in its mandate crops, except pearl millet. The Panel notes the significant investments made by ICRISAT to rationalize its germplasm collection (see Section 3.3) and upgrade its in-house capacity to conduct research in genomics, transgenics and bioinformatics during the period under review.

Except for lack of a full-time legume genomics scientist, GT1 has sufficient critical mass in applied genomics and bioinformatics, which could be augmented, if necessary, by its wide array of partners. However, the staffing in transgenic research has remained to this day, way below critical mass and needs to be addressed immediately if ICRISAT hopes to continue its success and create impact in this strategic niche.

The Panel concludes that ICRISAT's decision to pursue the course of biotechnology research has opened up tremendous opportunities and has given ICRISAT a distinct comparative advantage to conduct strategic research and generate international public goods for its mandate SAT crops (see discussions below).

1999 and 2000 Reports. The two reports considered by the EPR Panel in lieu of CCERs are: the1999 Consultant's Report on Applied Genomics Lab and the ICRISAT sub-Panel Report on Systemwide Review of Plant Breeding Methodologies in the CGIAR in 2000. The EPR Panel finds the reports candid, informative and useful. Both reviews came up with similar findings and recommendations in areas where they overlap. The Panel agrees with the findings and recommendations, and notes ICRISAT's positive responses and attempts to address them. However, the Panel notes that the lingering problem of effective

and operational integration of biotechnology with the genetic resources and plant breeding programmes at large remains to this day, an "unfinished business". This cannot be set-aside anymore if ICRISAT wants to re-establish its reputation as the world's leading germplasm and improvement research Centre of its five mandate crops for the SAT. The Panel's strong view on this issue is expounded in the recommendation made in section 5.2.

Strategic niches. The latest document relating to GT1 lists applied genomics and transgenic technologies to underpin its strategic niche in an identified problem/commodity area. The Panel concurs with this assessment and recognizes that at the international level, most of the Centre's mandate commodities have no alternative supplier of biotechnologies and transgenic products. The Centre should place more emphasis on strategic niches that it is uniquely qualified to address. The Panel urges ICRISAT to maximize this unique opportunity to build comparative advantage in the IT area to generate more international public goods not for ICRISAT alone but for the benefit of the entire CGIAR System.

Transgenics at ICRISAT. Transgenics, including those being developed by ICRISAT, are coming closer to the markets of Asia and Africa. But there's a huge gap between the "shelf and the market" as well as other concerns that must be addressed. The Panel notes some of the critical concerns.

Products and traits. Some CGIAR Centres, including ICRISAT, are developing transgenic lines as part of their product portfolio. Most CGIAR Centres have focused their conventional breeding efforts on technology transfer, and development and dissemination of intermediate products, such as pre-breeding lines, inbred lines, seed parents, elite germplasm, etc, and leave it to their NARS partners to further develop and distribute them as finished varieties. CGIAR Centres treat transgenic lines, much within the context of distributing breeding lines. However, breeding and release of transgenic cultivars are fundamentally different from those of conventionally bred cultivars. Development of transgenic varieties will dramatically affect the current methods and practices of varietal evaluation and release because of constraints posed by Intellectual Property (IP), biosafety and public acceptance issues (see discussion below). There's a huge gap in knowledge in this area of research. The Panel believes that ICRISAT has the comparative advantage and the opportunity to contribute to this gap in knowledge beyond the boundaries of SAT crops.

Intellectual Property issues. Plant breeders routinely combine useful genes from various sources into as many varieties as possible. The benefits of such method and practice are obvious. However, the IP issues inherent in proprietary technologies from different sources can severely restrict the breeding practices and consequently delay/stop the delivery of products to the target clients of ICRISAT. ICRISAT must ensure that it has full Freedom to Operate (FTO) for all transgenic products that it will develop and not leave it to their NARS partners to negotiate for its use.

Biosafety issues. Health and environmental issues will be the defining factors in the final dissemination and acceptance of transgenic crops. The enormous cost required for biosafety testing, particularly for novel traits, are beyond the capacity of most NARS to afford, even if they are willing to do so. There is real danger that due to lack of resources transgenic varieties derived from the CGIAR Centre products will be disseminated without rigorous biosafety analysis and approval. Very conservative estimates made by the private sector place the cost of Good Laboratory Practice (GLP) testing alone at US$4-5 M per product for commercial release. Environmental biosafety testing must be addressed too.

Studies on gene-flow, unintended targets, resistance management schemes and multi-location trials are standard requirements for release. Almost all national regulations for commercial release of transgenic crops, issue approval per transformation event and contain liability claims. Who will foot the bill for CGIAR products? Who will have custodianship of the transgenic products? Ex-ante and ex-post analyses of the product will be of enormous value for making decisions. For transgenics, methodologies are still being developed and there is much for ICRISAT to contribute in these areas of research particularly for SAT crops.

Public awareness and information dissemination. Public acceptance of transgenic crops will entail enormous efforts in communication to reach its SAT clients. The Panel urges ICRISAT to maximize this unique opportunity to build further comparative advantage in ICT-based distance learning systems to generate more international public goods.

In light of the above considerations, there is an urgent need for strategic research as well as enormous opportunities to generate international public goods within the continuum of technology development to product deployment in genomics and transgenics.

The Panel recommends that ICRISAT continue to undertake strategic research on genomics and transgenic product development for SAT crops; and together with other CGIAR Centres and relevant partners, address the pressing issues on intellectual property, biosafety and public acceptance of transgenic crops.

5.2 GT2 - Crop Improvement, Management and Utilization for Food Security and Health

The current structure of GT2 resulted from the consolidation of several projects. The expected deliverables are described by ICRISAT as being “Genetically diverse trait-specific populations and breeding lines; regionally adapted parental lines, varieties and hybrids; farmer participatory methods and products; impact-oriented IPM technologies; and opportunities for wider utilization of SAT crops.” These deliverables have been objectives of ICRISAT since its establishment in 1972; however, farmer participatory methods and products, and opportunities for wider utilization of SAT crops have received greater emphasis in recent years. The EPR Panel notes that evaluation of IPM technologies are also included in Global Theme 5 and from an organizational standpoint fit better in Global Theme 3 where we will discuss them. The Genetic Resources Unit also reports under GT2 with the objective of providing well-characterized accessions of ICRISAT-mandate crops to NARS and scientists world wide.

Presumably in response to the first recommendation of the last EPMR, GT2 has adopted a two-pronged breeding strategy underpinned by the vast and diverse germplasm collections of its mandate crops. The first is to breed varieties for those regions of the SAT where national programmes and private breeding companies do not have sufficient strength or activity to develop adequate quantities or qualities of cultivars. This strategy is being emphasized in sub-Saharan Africa for all of the mandate crops in those countries and zones where these crops can be grown. The second strategy, involves GT2 and GT1 programmes at Patancheru, India producing intermediate products, such as breeding lines with special traits, and improved breeding methods that assist GT2 breeding programmes in Africa, and NARS and private company breeding programmes in both sub-Saharan Africa and South Asia. In South Asia, and especially India, a major objective with sorghum and pearl millet is for GT2 to produce parental lines and breeding methods for use by NARS and private companies in

breeding hybrid varieties. GT2 programmes at Patancheru also have produced pure line cultivars of chickpea and groundnut and they are promoting the use of hybrid varieties of pigeonpea.

The ICRISAT Sub-Panel Report of the Systemwide Review of Plant Breeding Methodologies in the CGIAR (2000) provides important information for assessing activities under GT2 during recent years. The EPR concurs with the Sub-Panel assessment that the ICRISAT plant breeding programmes have had an excellent record of accomplishments but that a declining resource base, multiple changes in leadership, shifts in paradigm, and downsizing associated with these changes have seriously weakened the programmes such that "There is a need to re-build the critical mass in staff size of ICRISAT Plant Breeding Programmes." The following analysis indicates the extent of this problem in Africa where GT2 now deploys 6 scientific staff positions and 12 support staff.

In sub-Saharan Africa, as of 2003, ICRISAT did not have a single comprehensive pearl millet breeding programme. ICRISAT has a sorghum breeding programme with one IRS position in Mali and partial programmes in Kenya and Zimbabwe. The programme in Mali gives very strong emphasis to using Guinea-race sorghum germplasm and as such may be missing some breeding opportunities that could be gained by including more Caudatum-race and other sorghum germplasm in the breeding programme. ICRISAT only has part-time breeding programmes in groundnut (in Mali) and pigeonpea (in Kenya), and modest chickpea breeding activities in Africa. None of the ICRISAT breeding programmes in Africa appear to have the levels of scientific staff support in plant pathology, entomology and weed science needed by first-class plant breeding programmes for these crop species. It is not prudent for ICRISAT to mainly rely on breeding programmes at Patancheru, India as the source of germplasm for Africa. These materials are unlikely to be very effective as varieties in Africa due to the large genotype x environment interactions that often occur.

Significant loss in ability to conduct conventional plant breeding also has occurred at Patancheru, India where 7 scientific staff are now deployed and about 12 support staff. In contrast, staffing and resources in biotechnology (GT1) have increased substantially in recent years (refer to section 5.1). The upstream breeding practiced by GT2 at Patancheru does, however, have the opportunity to benefit from the projects of GT1 involved in the development of transgenic lines and methods for DNA marker-assisted selection, but this will require very close collaboration between GT1 and GT2 personnel. To be most effective, ICRISAT should have a single comprehensive strategic genetic resources and germplasm enhancement programme at Patencheru that effectively integrates biotechnological techniques with conventional varietal improvement methods. The current separation of these activities into two themes, GT1 and GT2, might have been desirable while GT1 was being established but a seamless merging of their activities is now needed at Patancheru.

During the period under review, ICRISAT appears to have followed a strategy based on the Terms of Reference for the Sub-Panel, which stated "assess the possibility of freeing up resources, implicitly by reducing the resources involved with Conventional Plant Breeding, so that applications on new techniques (Biotechnology) could be expanded as appropriate". However, the action of ICRISAT is contrary to the Sub-Panel recommendation that Conventional Plant Breeding should be strengthened not weakened. The Sub-Panel used the following arguments to support their position on this issue. "The basic premise for this aim appears to be based on the belief that Plant Breeding at CGIAR Centres is generally strong, and Biotechnology, as practiced by Centre scientists have generated good results and

[are] beginning to replace efforts in Plant Breeding. We believe this premise, at least in the case of ICRISAT is incorrect. First, Plant Breeding at ICRISAT is not as strong as it used to be. Secondly, the new effort in biotechnology has not produced germplasm or cultivars [such] that it can now replace plant breeding. Furthermore, experience elsewhere, the US seed industry for instance, suggests that even when Biotechnology generates valuable germplasm, an increase (not a decrease) in efforts of a strengthened Plant Breeding programme is actually warranted". The EPR Panel believes that these arguments are even more valid in 2003 than they were in 2000.

Careful prioritization in choice of traits for crop improvement programmes is critical for success in plant breeding. Some traits being pursued by both GT2 and GT1, such as resistance to specific important pests and diseases, are clearly of very high priority. Note that private biotechnology companies have put major emphasis on pest resistance, illustrating their perception of its value. Unfortunately, biotechnology companies are unlikely to do this type of work for the mandate crop species of ICRISAT.

Droughts can be a major limitation to crop production under rainfed conditions in the SAT but work by ICRISAT on adaptation to drought must be carefully targeted if it is to achieve important results in a reasonable time frame. The most reliable method for enhancing adaptation to drought of grain crops is to select for yield in the target production environment where the variety will be grown by farmers. Conventional plant breeding has made progress using this technique and while this has been difficult work, and progress has been slow, it still is used because it has been effective and reliable. While ICRISAT has obtained indications that use of DNA markers may be effective in indirect selection for yield, the results are preliminary. Confirmatory studies are needed because theory predicts it is extremely difficult to reliably detect useful genotypic (G) differences in yield, while using the many lines required to obtain effective markers for very complex traits, due to the difficulty of separating out effects on yield due to environment (E) and G x E. Consequently, ICRISAT also should continue to focus on selecting for lower level traits that have been shown to be effective in specific circumstances, such as optimal phenology, root traits, leaf stay-green and water-use efficiency, which may complement selection for yield and provide more effective strategies for enhancing adaptation to drought. ICRISAT has been pursuing these intermediate level traits using both phenotypic and marker-assisted selection in GT2 and GT1.

The Sub-Panel recommended that ICRISAT plant breeding programmes should develop improved and clearly delineated collaborative relationships with the INTSORMIL and Peanut CRSPs because the complementarily and resource saving that can accrue to both parties from such associations can be significant. The EPR Panel agrees with this recommendation because these CRSPs are active in sub-Saharan Africa, have substantial access to advanced research laboratories in the US, and provide comprehensive opportunities for graduate education. ICRISAT documents provided to the Panel did not provide much discussion of this issue. ICRISAT has collaborated extensively with the Peanut CRSP in the last five years. Current collaboration is in the areas of management of aflatoxin and rosette, and in joint publication of the International Arachis Newsletter, which is less than the collaboration in earlier years. This is unfortunate because it will limit the progress that can be made in helping poor people in Africa by either ICRISAT or the Peanut CRSP.

ICRISAT also has collaborated extensively with INTSORMIL in the last five years. In 1998, INTSORMIL signed a memorandum of understanding with the ICRISAT managed SMIP and an agreement incorporating six INTSORMIL-funded regional projects into the

SMINET research portfolio. Presumably this collaboration will be weakened considerably when the projected termination of SMIP occurs in 2003. The loss of SMIP probably would result in reduced crop improvement activities in southern Africa by both ICRISAT and INTSORMIL. Controversy still remains as to whether ICRISAT and INTSORMIL should focus on the collaborative development of hybrid or open-pollinated varieties of sorghum and pearl millet with different African NARS. Strong collaboration with INTSORMIL could assist ICRISAT in developing the most effective strategies concerning the development and deployment of sorghum and pearl millet varieties and seed systems in different parts of sub-Saharan Africa.

Plant breeding and germplasm enhancement programmes need to be stable if they are to be adequately effective because they substantially benefit from a long-term outlook and management. In recent years, high turn-over of senior staff and frequent transfers have occurred and will continue to occur with projected retirements that can be particularly damaging to plant breeding programmes due to the long time-frames of many activities conducted by these programmes. Many of the worlds most successful plant breeders had the opportunity to work for many years on the same plant breeding programmes. The EPR Panel is of the opinion that ICRISAT should try to enhance the stability and effectiveness of the crop improvement teams by developing appropriate staff recruitment and deployment strategies. These strategies should minimize transfers and provide sufficient overlapping of personnel so that newly recruited plant breeders can learn from the previous breeders who they are replacing.

With regard to the genetic resources activities, the Panel agrees with the positive assessment of the Sub-Panel. The EPR Panel strongly believes that while further substantial progress has been made including the establishment of core and mini-core collections for the five ICRISAT-mandate crop species (refer to section 2.2), the vast potential of the ICRISAT germplasm collection still remain beyond the reach of plant breeding programmes. Application of biotechnological tools is needed to realize this potential through the efforts of highly effective and truly integrated crop improvement programmes for all of ICRISATs mandate crops.

In light of the facts and assessments made in the preceding sections as well as in section 5.1:

> **The Panel recommends that ICRISAT should maximize the synergy possible when GT1 (Harnessing Biotechnology for the Poor) and GT2 (Crop Improvement, Management and Utilization for Food Security and Health) plus their partners work closely together to generate International Public Goods for the SAT. ICRISAT should rapidly re-engineer and rebuild its crop improvement programmes and further enhance the evolution of the two-pronged breeding strategy for Asia and Africa.**

5.3 GT3 - Water, Soil and Agro-biodiversity Management for Ecosystem Health

5.3.1 Water and Soil

This Global Theme resulted from the amalgamation of previous P1 (Raising soil productivity to help SAT farmers grow their way out of poverty) and P2 (Efficient use of natural resources in watersheds) and part of P3 (Farmer participatory approaches to integrated pest and disease management). According to the Major Issues Paper prepared by ICRISAT this environmental research will be firmly anchored on the integration of genetic and natural resource management strategies, particularly to adaptation to drought and water and nutrient use efficiency. The new focus will be on income-generating options for managing soil, water and agro-biodiversity. This involves the development of low cost, input efficient, integrated natural resource management strategies, low-cost water catchments and conservation systems, managing agro-biodiversity for ecosystem sustainability, and institutional and policy reform for water usage. The Vision and Strategy paper states that, in contrast to recommendations made by the 4th EPMR, ICRISAT will be active in both Asia and Africa. However, in the subsequently prepared Issues Paper for this EPR Panel (p. 7), the Centre seeks advice on whether it has the Africa-Asia balance right. At present the regional projects include:

- Diversification of income-generating options for improved livelihood, agro-ecosystem health in the SAT of WCA.
- Enhance agro-biodiversity and catchment management for agro-ecosystem health in East Africa
- Improve livelihood strategies of the rural poor through integrated soil, water and nutrient management in Southern Africa
- Improve rural livelihoods through sustainable management of watersheds in Asia

ICRISAT continues to be heavily invested in watershed work in Asia, even beyond the mandate region. The work includes small dams with micro-perimeters, alternative soil management systems, provision of germplasm, vermiculture and monitoring and economic evaluation at a community level. In Africa, ICRISAT continues to pursue the targeting of fertilizers (micro-dosing), management options for manure and or residues, and managing agro-biodiversity for ecosystem sustainability. GT3 also continues to promote system simulation as a tool to increase research impact (see 2.3). Farmer participatory methods and promoting farmer field schools are further tools for scaling out and assuring impact.

Assessment

GT3 emerged from part of the NRM programme and was evaluated by a CCER in 2001. The CCER was of limited help to the Panel in passing judgment on the track-record of GT3. Though it argues that the EPMR did not suggest that NRM work in India be sacrificed for the sake of expansion in Africa, this Panel concludes that with the limited resources available, Africa should be given priority. From our observations and discussions with NARS, we also conclude that ICRISAT does not have a comparative advantage in this area of research in India and possibly in Asia as a whole, regardless of whether donors are interested in involving ICRISAT in this work. There is little doubt that ICRISAT adds flavour and some upstream NRM technology to the Watershed project consortium, but it would be hard to argue that this input could not be provided by the Indian NARS. The possible exception might be the supply of novel germplasm but this could be handled by GT2. Surprisingly, few activities

have been in place to transfer this knowledge to Africa where the concept of watershed management is in its infancy. A watershed project in Northern Ethiopia was terminated prematurely when funds ran out. Given the drastic loss of the natural resource base on this continent, the need is urgent. ICRISAT is seeking funding to build up a watershed project in Eastern Africa with the help of a joint appointee with ICRAF in Nairobi.

For Africa, the CCER strongly endorsed ICRISAT involvement in NRM research but hesitated to classify the output as IPGs. With the exception of the development of models as tools, the Panel concurs that much of the research done and proposed by GT3 is too far downstream to insure the generation of international public goods. Regarding the models, the Panel is pleased to note that they have advanced to an early stage of applicability. It might be advisable to carefully evaluate the acceptability of this tool to change agents and farmers in a few years before deciding the fate of this endeavour.

Although the activities proposed under GT3 address serious issues confronting farmers and are worthy of attention, these programmes do not take into account that African farmers are often constrained by policies and actions taken by the government. Thus, the best micro-dosing technology is of limited value in a country that does not assure access to input markets. Similarly, targeting income generating technologies at the farm level without assessing the effect on the environment or economy as a whole may not be sufficient. There is a dire need in the African SAT to assist national policy makers in shaping their land use, water rights, management and marketing policies such that the farmers will be enabled to implement the practices that are beneficial to them and the environment and avoid conflicts.

Whereas the scaling-out of farm technologies can be done by agencies with better access to the farmer, scaling-up requires an agency that has access to the required tools such as Remote Sensing, modern GIS-based models and the interdisciplinary teams necessary to tackle these complex issues. Who will do this type of work in the African SAT if not ICRISAT? ICRISAT should reconsider its largely field-scale-based programme on NRM and broaden the spectrum of NRM research to larger watersheds in the African SAT, in which communities with contrasting interest are sharing resources. To reflect this commitment, the GT might consider renaming itself Land, Water and Agro-biodiversity management for Ecosystem Health. The example above was given for illustrative purposes only. Other research challenges that concern the African SAT are the rapid loss of soil organic matter and particularly of the quality of this important soil constituent, the management of small perimeters of the rapidly sprouting small dams by farmers with no expertise in irrigated farming etc.

The GT3 programme as part of the NRM commitment of the Centre is operating far below critical mass with only 18 Ph. D.-level scientist, 11 of whom are in Asia. The remaining are spread over 3 locations in Africa. Support staff is weak in both regions; 4 in Asia and 8 in Africa. The Panel considers the current research agenda for GT3, understaffed and to be too dispersed and lacking in strategic components requiring longer-term funding. The GT3 commitment in Africa has dropped below critical mass. The recent addition of components of the Desert Margin Programme (discussed below) does little to alleviate these problems.

The Panel recommends that ICRISAT phases out GT3 (Water, Soil and Agrobiodiversity Management) research in Asia where it no longer has a comparative advantage, by devolving this research to NARS. These resources should be redeployed in Africa where they should be engaged in addressing some of the major challenges in land, water and agro-biodiversity research facing the SAT of that continent.

5.3.2 Integrated Pest and Disease Management

One of the key purposes of GT3 is pest management (MTP 2003-2005). However, no milestones reflecting this purpose were explicitly identified as staff from Integrated Pest Management (IPM) and Integrated Disease Management (IDM) placed their work in GT2 and GT5 in 2002. The previous Centre Project 3, which was operational up to about 2001, described ICRISAT's goal for these activities. It is to reduce poverty among smallholders by increasing the productivity of SAT cereal/legume systems through the development and adoption of eco-friendly pest and disease management options integrated with improved pest- and disease-resistant varieties. IPM/IDM is a holistic multidisciplinary management approach that integrates various prevention and control methods on the basis of ecological and economical principles to combat pests and diseases.

In South Asia, total crop losses due to pests and diseases are common even with substantial use of pesticides. This use of pesticides also has resulted in some environmental degradation, operational health hazards, and diminished profits. In Africa, IPM/IDM are critical needs because smallholder farmers, for the most part, do not yet have sufficient resources to adopt extensive chemical control measures. Use of some pesticides is increasing but it is potentially hazardous to smallholders who may not fully understand the dangers or for various reasons do not adequately follow the precautions needed in using them. The Panel considers that there is a greater need for IPM/IDM research and development activities by ICRISAT in sub-Saharan Africa than in South Asia. In general, NARES in South Asia have greater capacity to develop and extend these technologies than NARES in Africa. In principle, however, many of the IPM and IDM technologies developed by ICRISAT are IPGs and some are relevant in areas of both Africa and South Asia.

Though host plant resistance can be the most stable and least-cost approach to managing pests and diseases in smallholder systems in the SAT, adequate levels of resistance often are not available for all of the biotic constraints. Therefore, the strategy ICRISAT used is to combine all available effective tools in a holistic system: resistant varieties, improved agronomy, judicious use of synthetic pesticides and botanical pesticides, and use of biological control agents. In developing and extending IPM/IDM technologies ICRISAT has taken a participatory approach, which is highly appropriate for these types of activities. Full integration of farmers into the processes of technology development, testing and assessment is critical because IPM/IDM, in essence, replace use of pesticides by information technology. Without a participatory process, IPM and IDM technologies could be difficult for extension agents to understand and for farmers to practice and thus adopt, especially for the many farmers with limited formal education and resources. Hands-on training of NGOs, NARS scientist and farmers has been an important activity. Various networks have been established that focus on IPM, IDM and other research areas including: ICRISAT-CLAN (Cereals-Legumes-Asia network), ROCAFREMI (for pearl millet in 14 African countries) and ROCARS (for sorghum in 18 African countries).

ICRISAT has conducted a broad range of IPM/IDM research and development in both South Asia and Africa since the last EPMR. Some research in South Asia has resulted in technologies that have been adopted by farmers. Pod borer in pigeonpea and chickpea has been managed with biological control agents (a virus and a fungus), and traditional techniques, such as manual shaking and providing perches for birds. Bud necrosis and rosette disease have been controlled in groundnut by using resistant varieties and agronomic practices, such as increased plant density. Methods were developed for managing botrytis gray mold in chickpea. Sunflower was identified as an effective trap crop for the insect pest Spodoptera. Foliar diseases of groundnut have been controlled by combining resistant cultivars and carefully timed sprays with fungicides. Head bug in sorghum was controlled by avoiding multiple sowing dates, spraying with insecticide and using an alternate host plant. Some of these activities resulted in substantial achievements and impacts and were highlighted in section 2.3. Other research underway in Africa includes the development of IPM/IDM technologies for stem borer, head miner and downy mildew in pearl millet, and for early leaf spot and late leaf spot in groundnut

The Panel considers this to be an area of very high priority for ICRISAT. The range of activities is so broad, however, that it may result in resources being spread too thinly to be fully effective.

The Panel recommends that ICRISAT prioritize and consolidate its activities in Integrated Pest Management (IPM) and Integrated Disease Management (IDM). Potential projects should be chosen with priority being given to projects that address constraints that are important in Africa and are potentially solvable through IPM or IDM approaches.

5.4 GT4 - Sustainable Seed Supply Systems for Productivity

GT4 evolved primarily as a result of adoption studies, which indicated that access to seed was a major obstacle in using improved seeds, especially in Africa. It was also in response to the expressed requests from the NARS networks for active involvement of ICRISAT in their breeding programmes, particularly in backstopping, training, fund-raising and information sharing activities. Like all other Global Thematic Areas, GT4 evolved from the merger of several projects: SEPP-S4 (More efficient seed systems, and the impact of new varieties on farm biodiversity) of the Socioeconomics and Policy Programme (SEPP) and a seed system-related GREP project (G4: Partnerships to share breeding materials in farmer-friendly forms) into GREP project P8: Improving seed supply for research impact (MTP 2001-2003). After the project portfolio in MTP 2002-2004 was reduced from 12 to 10, Project P8 was re-numbered to P7. In 2002, P7 was elevated into global theme GT4, with a Global Theme Leader (GTL) located in ICRISAT-East Africa.

Throughout its evolution, GT4's goal has remained essentially the same i.e., to increase the productivity of farming systems in the SAT through increased use of modern varieties. This was slightly expanded recently to include the use of diverse germplasm (MTP 2003-2005). Its stated purpose is to develop and evaluate more efficient and cost-effective seed supply options and institutional arrangements.

In order to attain its goal and purpose, GT4 (and its forerunners, S4, G4 and P8/P7), implemented a wide range of activities, largely in Africa, to analyze various seed systems, including farmer- and community- based systems, emergency relief systems and formal seed

systems in collaboration with a wide range of partners. GT4 has concentrated its efforts in the following areas:

Breeder and foundation seed supply. This project aims to provide financial and technical management options for multiplication of breeder and foundation seed of publicly developed varieties available for testing by interested stakeholders. In the period under review, it established revolving funds for breeder seed production of SAT crops in India and a number of countries in Africa (Malawi, Tanzania, Zimbabwe and Mozambique). It also developed seed catalogs and established links to community seed production. Based on these activities, ICRISAT has provided recommendations on seed certification e.g., truthfully labeled seed policy, in Tanzania. Work is in progress on comparative case studies on the development of financial and technical management option and draft policy recommendations for NARES on seed sources.

Seed supply for food crops. This area includes a number of activities aimed at providing seed supply options to broaden the range and diversity of food security crops grown by farmers in the semi-arid tropics. The work resulted in the documentation of seed management practices, pilot testing of seed production with primary schools and marketing of small seed packs through rural markets. Current activities aim at identifying uptake pathways for modern groundnut varieties and providing draft policy recommendations to strengthen farmer seed systems. More recent work is extending the focus to adoption studies to quantify impact and to scaling-up – in other crops and regions.

Emergency/relief seed supply options. The main focus of this area is to develop recommendations for seed interventions by humanitarian agencies in situations of chronic political instability and/or following natural disasters. Notable accomplishments includes the small seed pack programme implemented in Somalia, impact assessment of a relief programme in West Africa and demand driven research in Mozambique. The latter implemented a number of successful activities e.g., seed fairs in 2001 and 2002 that led to the development and institutionalization of seed supply assessment tools and the Research Committee recommendation for the Doreen Mashler Award. In addition to seed needs assessment output, this work published a seed fair manual, special issue of Disasters ‘Beyond Seeds and Tools’ and a manual for seed-based agricultural recovery.

Seed supply for commercially traded crops. This area includes a range of activities related to commercialization of SAT commodities and institutional issues in public-private partnerships. The focus of this area is to identify sustainable seed supply options available for commercially traded crops of importance to farmers in the semi-arid tropics. In the period under review, ICRISAT has helped to pilot interventions to stimulate demand and to link community seed production to a commercial seed company, and has completed a number of case studies. More recently, the project initiated a number of activities to increase groundnut, chickpea and pigeonpea seed production in several countries in Africa.

Seed policy research. This area aims to provide policy options for national governments, regional organizations, and international bodies that will broaden the range of crop and varietal options for farmers in the semi-arid tropics. Research outputs include analysis of returns to regional seed markets and a policy draft on regionalized breeding/release.

Critical Mass

GT4 has a total staff complement of scientist and support staff contributing the equivalent of 14.35 PY. There are 8 IRS and 7 RRS, including the Global Theme Leader, contributing the equivalent of 6.45 person year in 7 locations across South and East Africa (4.8 PY) and West Africa (1.3 PY) and in Asia (0.35 PY). All scientists are trained in various disciplines (farming systems, seed science, breeding and economics) and have been with ICRISAT for at least six years. There is tendency for most of the IRS to allocate efforts across several projects, resulting in fragmentation of relatively small time allocations for some projects and activities.

Assessment

The EPR Panel commends the efforts of GT4 staff in providing technical assistance in seed multiplication and in promoting alternative seed delivery systems in Africa. The Panel notes further the innovative research collaborations they have established with a wide range of partners that included NARS, NGOs, farmer groups, private seed companies, the business sector and ARIs. The Panel believes that it is essential for ICRISAT to define explicitly its role and exit strategies in the research projects, particularly with regard to NGOs and the private sector.

Overall, GT4 has maintained a focus that is relevant to the marketing aspects of this theme. However, the Panel notes the following:

- GT4 is considered by ICRISAT as a new area of research designed to bring together the seed production and marketing aspects of the seed sector. However, GT4's goal and purpose has remained essentially that of the former SEPP-S4. There is insufficient and/or lack of attention to the genetic resources, crop improvement and utilization components that are supposed to be addressed by this theme. It limits itself to a practical agenda involving seed production, training and a future plan for screening germplasm.

- Hybrids and transgenics, including those being developed by ICRISAT's GT1 and GT2, are reaching closer to the markets in Asia and Africa. There is an urgent need for strategic research in seed systems, seed movement and market chains as well as ex-ante analysis, especially in evaluating transgenic products, which could be best carried out with GT1 and GT6.

- The great majority of current activities and outputs of GT4 are more attuned to addressing immediate problems, and relegate much of their staff time to practical and applied research agenda that will likely produce limited strategic research results and IPG's relevant to SAT needs.

- GT4 is also supposed to address the seed system aspects of GT3 and GT5. However, there is no mention of any activity related to these GTs.

- GT4 addresses cross-cutting issues and requires a strong link with GT6, which has the socioeconomics and institutional expertise.

In light of the above considerations:

The Panel recommends that ICRISAT rationalize the role, scope and objectives in terms of its comparative advantage in conducting research generating IPGs in GT4 (Seed systems). This includes addressing the anticipated problems related to marketing transgenic materials it will produce. The purposes and goals of GT4 will be best served if its activities are strongly anchored into appropriate global themes where interdisciplinarity can be enhanced and resources more efficiently and effectively utilized.

5.5 GT5 - Enhancing Crop-Livestock Productivity and Systems Diversification

GT5 was created in order to assemble previous activities in crop diversification and explicitly address a new area identified as a result of the SAT Futures study, i.e. livestock integration. The stated goal is to improve livelihoods and sustainability through strengthened crop-livestock integration and system diversification options. Priority areas of research are 1) Enhancing crop-livestock productivity through improved feed quantity and quality; 2) Alleviating rural poverty through system diversification and income generation; 3) Evaluation of sustainable IPM techniques in diversified systems; and 4) Enhanced partnerships, capacity building, and information sharing

The theme expects to produce the following outputs:

- Dual-purpose cultivars of legumes and cereals with enhanced feed value evaluated and promoted in mixed production systems (link with GT2)
- Eco-friendly IPM options to ensure good quality fodder and feed evaluated and disseminated (link with GT2-GT3)
- Nutrient use optimization through a better integration at the household level of manure and inorganic fertilizers in crop-livestock systems (link with GT3))
- Agronomical and economical performance of non-conventional annual/perennial crops in SAT systems evaluated
- Assessment of the market prospects for non-traditional crops (in coordination with GT6)
- Income diversification, risk management strategies, and sustainability enhancing options identified and packaged in decision support systems (in coordination with GT3 and GT6)

Current Activities

Five IRS/RRS staff have GT5 as their primary GT, with a total of 4.6 person years allocated to the theme, out of which 0.9 is contributed by scientists primarily attached to other themes. One person year is contributed by staff located in India and 3.6 by staff located in West and Central Africa (WCA). There is currently no staff input in East or Southern Africa.

In WCA current activities include testing of novel short guinea-race sorghum populations and progenies which appear to combine adaptation and improved stover quality; study of integrated nutrient management in crop-livestock systems (organic matter management, nutrient cycling), socioeconomics analysis of systems diversification; and testing of new integrated farming systems – the African Market Garden (AMG) and the Sahelian Eco-Farm (SEF).

The AMG is a drip-irrigated garden introducing new crops (dates, figs, grapes, and pomegranates). The SEF model is intended to provide simultaneous solutions to the constraints of present systems by integrating principles, technologies and management packages developed and tested at ICRISAT Sahelian Centre over the past 20 years (soil mulching for arresting wind and water erosion and for soil enrichment with carbon and nutrients, crop rotation to improve soil fertility, fertilizer placement for efficient use, earth bunds and micro-catchments for arresting soil erosion and for water harvesting, nitrogen fixing trees, Pomme de Sahel - the domesticated fruit tree *Ziziphus mauritiana*), accompanied by research on a number of cash crops to both diversify and increase the profitability of the Sahelian rain-fed agricultural system (sesame, cluster beans, roselle, and watermelon).

GT5 is contributing to the Desert Margins Programme (DMP) by developing sustainable alternative livelihoods, enhancing crop-livestock integration, promoting crop diversification, developing a range of water and nutrient management options for rainfed and irrigated systems, and supporting NARS for the development of NRM technologies.

In collaboration with GT2, GT5 is working on IPM in systems including head bug, millet stem borer and striga management, termite-aflatoxin interactions, management of viruses (PCV/GRV) and downy mildew, as well as pest and disease monitoring and dynamics in new crops and systems (AMG, SEF). The thrust is also developing decision support systems, and is implement a training programme which targets various stakeholders (vegetable seed production, fruit tree propagation, care of tissue culture propagated date palms and training of farmers adopting the AMGs).

In Asia current activities include quantification of effects of plant diseases on crop-residues of sorghum and groundnut (on station evaluation of the effects of foliar diseases on crop residues), commercialization of *stylosanthes* production (under a research project funded by ACIAR poultry feed trials are being carried out in India) silvipasture for women's empowerment (stylosanthes seed production by women self help groups under urban forestry project in Hyderabad) alleviating rural poverty through system diversification in Asia (evaluation of the role of legumes for the diversification of the rice-wheat cropping systems, rehabilitation of chickpea through IPM in the rice fallows in Nepal, introduction of pigeonpea in the RWCS scaled up to improve the cropping intensity and resource conservation in NW India, and IPM in West and Central India).

In Asia and WCA GT5 is building and enhancing partnership for impact through regional meetings and work-plans, scientific quality control and regional theme integration, targeted biotech R&D for specific demand driven traits, and varietal evaluation and seed systems.

Assessment

As indicated in section 2.3 past research activities on crop diversification at ICRISAT have not yet led to any discernible contributions to knowledge in the SAT.

The current activities in GT5 in WCA cover a very wide range from addressing individual components (agronomic evaluation of new crops in WCA, assessment of feed quality of new germplasm, etc.) to work with whole systems (the AMG and SEF). The Panel concurs with ICRISAT's attempts to test new crops and integrated systems for the African

SAT's. However, while the Panel commends the staff for the energy and enthusiasm displayed, it is clear that the scope of the work programme is far in excess of what can be expected given the current human resources available.

Furthermore, the Panel saw very little evidence of strategic research that would lead to the understanding of the functioning of the systems being tested, a necessary activity for the production of IPGs. For example there is no indication of the necessary instrumentation to measure the effect of erosion, nutrient cycling, or to record crucial labor use data on the new systems being tested on-station in Sadore? let alone those to be tested on farm. The need to pay careful attention to ex-ante analysis to ensure that new systems increase labor productivity is clearly illustrated by the fact that one of the SEF models with sorrel, and the $80m^2$ AMG have been shown to be uneconomical. In addition there is no indication of the necessary landscape analysis in order to stratify the production potential of target areas into which the benchmark production systems being developed would be fitted and development pathways analysed based on projected scenarios.

Because of limitations of staff there is no work underway in East or Southern Africa. The Panel feels that this is a major limitation in the work programme of GT5 given the increasing importance of livestock systems in those regions and the need to develop innovative crop-livestock systems. This need is recognized by the leadership of the theme which has given first priority to the recruitment of staff for these regions under a scenario of a 10% global increase in funding to ICRISAT.

In conclusion, the Panel feels that current work in sub-Saharan Africa is not up to the standard expected of strategic research in the CGIAR. Furthermore, it sees little evidence of anything innovative in the GT5 work in Asia, and is not convinced that ICRISAT has any comparative advantage in Asia, or is likely to make any meaningful contribution to knowledge in its work in this area.

Furthermore, with the current staff strength and the synergies with GT3, the Panel believes there is currently little justification for having this area of work as a stand alone theme.

The Panel recommends that GT5 (Enhancing crop-livestock productivity and systems diversification) should transfer assessment of feed quality to GT2 (Crop Improvement, management and utilization) and cease its other activities in Asia. The level of staffing should be increased, and strategic research in sub-Saharan Africa expanded, particularly in landscape level research on new systems. To ensure coherence in ICRISAT's programmes this theme should be merged with GT3 (Water, soil and agro-biodiversity management).

5.6 GT6 - SAT Futures and Development Pathways

The objective of GT6 is to provide essential social science direction for ICRISAT's research through strategic assessment of future scenarios for agriculture and livelihood strategies in the rural SAT. This would include functional strategies to facilitate technology utilization; evaluation of prospects for diversification (higher value crops) and commercialization of SAT crops; micro-level assessment of the dynamics and determinants of poverty; identification of new institutional arrangements for research and development; and effective targeting of spillovers based on institutional experience.

The activities of the Impact Assessment Office (IAO) have been incorporated into GT6. Here, the goal is to improve the efficiency of agricultural research systems and the policy environment to ensure that research investments generate sustainable improvements in livelihoods and poverty reduction in the SAT.

Activities

Eight of the eleven IRS social scientists are now located in GT6. Most also work on research topics in other themes, and ICRISAT management estimates that about 45% of the time of social scientists is currently allocated to tasks in the other GTs, mainly GT3 (16%) and GT4 (17%).

The current research agenda is carried out by focusing on three key areas 1) Strategic assessments for agriculture and economic growth in the semi-arid tropics of Asia and Africa and implications for agricultural research priorities; 2) Development pathways and policies for rural livelihoods; 3) Synthesis studies of lessons learned from impact studies, institutional arrangements and implications for research spillages across regions.

Linkages with the other GTs target analytical contributions relating to the evaluation of technology investment trade-offs and resource pricing issues. These focus on:

- Farmer investment strategies in soil and water management technologies (with GT3)
- Seed systems and commercialization (with GT4), and
- Priority setting, adoption and impact assessment (with all GTs)

Key areas of social science research in the past five years were adoption and impact studies documenting technology development and rates of return to ICRISAT's crop improvement and resource management research, seed systems and commercialization opportunities for SAT farmers, reviews of the current and projected outlook for ICRISAT's mandate crops, studies of input/output markets, and resource economics (soil fertility, water, and crop management).

Social science research also assessed changes, trends, and continuing constraints in SAT agriculture, and implications for ICRISAT's future research agenda and priorities. This is structured around the "SAT Futures and Development Pathways" global theme, which was launched with a series of consultations with partners in Asia and Africa. Results from these brainstorming meetings were analyzed, and complemented by a broad-ranging study by two internationally reputed consultants with expertise in SAT agricultural economics. The results guided the development of a new vision and strategy for ICRISAT. As a follow-up to this initiative, two stakeholder workshops, one in Africa and the other in Asia, were held in 2002 to discuss alternative scenarios for targeting research for development. The meetings concluded with a series of recommendations for better targeting of agricultural research to achieve agricultural transformation in the semi-arid tropics of Africa and Asia.

Village Level Studies (VLS) conducted between 1975 and 1985, have been resumed, in Zimbabwe (Southern Africa), Burkina Faso (WCA) and India (Asia). The new data, through comparative analysis using the earlier dataset, will provide insights into various aspects of the dynamics of the rural economy in the SAT, including household nutrition,

social institutions, technology utilization, crop-livestock interactions, income and expenditure patterns, household decision-making and the processes and determinants of welfare change

Impact studies have gone beyond focusing on income and poverty. Other dimensions of poverty especially the social capital aspect are incorporated in some studies. Social capital - in terms of increased ability and willingness to co-operate and work together for achieving common goals, and, sustaining and developing norms and networks for collective action - is crucial for successful uptake, diffusion, and impact of agricultural innovations. Current work includes strategic assessment of alternatives to biotechnology research and development of improved methods for assessing natural resource management research.

The extent and likelihood of technology spillover from finished products is negatively related to the research capability of NARS. Potential spill over benefits from ICRISAT research in India to Africa is being assessed in order to determine the need for a separate breeding strategy by ICRISAT for strong and weak NARS.

Previous research has identified the binding biophysical constraints to agriculture in both the Asia and African SAT as water resources and soil fertility management. Current studies address these areas. Diversification of agriculture is being addressed through a series of collaborative studies of factors influencing shifts to high value commodities.

Concerns about the limited adoption of improved sorghum and pearl millet varieties in southern Africa led ICRISAT’s economists to initiate a series of studies on national and regional seed systems during the past five years. These studies have provided the foundation for ICRISAT’s global theme on seed system development, adding an analytical component to efforts to multiply and distribute improved seed.

Commercialization opportunities are being identified for under researched food crops, providing marketing outlets for smallholder farmers to market surplus grain and increasing their incentive to invest in productivity-enhancing technology. Partnerships with the private sector have helped identify specific opportunities for industrial use of sorghum (e.g. in brewing and starch manufacture), and encouraged private sector investment in processing (e.g. by pigeon pea processors in Malawi and Kenya). Pilot contract grower schemes are bringing smallholder farmers together with grain traders, seed companies and others.

Assessment

In the view of the Panel, ICRISAT’s social science research over the review period has contributed to the knowledge base on semi-arid agriculture, helped inform decision making on strategic policy issues, documented impacts generated by ICRISAT technologies and the resulting rates of return to donor investment and has built up a network of partnerships as the base for further collaborative studies.

An insightful CCER of the Socioeconomics and Policy Programme was conducted early in 2002. It found that a highly committed, competent and motivated team of social scientists had carried out a productive programme in the 1996-2001 period, in terms of applied country-specific publications, that had contributed considerably to capacity development in NARS. The CCER Panel was also able to identify a number of significant impacts of the programme during the period, including contributions to changes in ICRISAT's overall strategy, contributions to national capacity, and contributions to policy. The

Programme was commended for developing diverse partnerships that have greatly enhanced its multiplier effects, especially in partner countries.

On the negative side, the CCER Panel found that staff are spread very thinly across a wide range of activities and this has often compromised the quality and timeliness of work. Most of the work is very applied in nature and little strategic research is being conducted. Despite the broad coverage of the work programme, there has also been little effort to synthesize results across countries and regions to draw overall lessons and implications for SAT. Finally, the Programme has not maintained its tradition of making significant contributions to the social sciences profession and body of knowledge on SAT, through international journal and book publication.

Almost two years on, this EPR Panel has seen some evidence of increased output from the social scientists in the form of publications on research strategies, and some work plans indicate increased attention to more strategic issues. However, many of the conclusions of the CCER remain valid, particularly those relating to the fact that most social science work is still very applied in nature with little strategic research content. The Programme is not moving vigorously enough to regain its tradition of making significant contributions to social science body of knowledge. The Panel is disappointed that the recommendation of the CCER to allocate the *majority* of social science resources to GT3, GT4 and GT5 has not been fully adopted. GT5 for example is allocated only 1% of time of social scientists.

The Panel recommends more vigorous implementation of the recommendations of the CCER of Socioeconomics and Policy Research Programme at ICRISAT, 1996-2001. More social science resources should be re-allocated from GT6 (SAT Futures and Development Pathways) to the other themes under the leadership of non social scientists and the work programme should be more sharply focused on strategic assessments and activities that best inform macro and longer-run priority setting in ICRISAT.

5.7 The Desert Margins Programme (DMP)

Dryland degradation and desertification, defined as land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities, is a major world-wide problem, affecting an estimated 100 billion ha in more than 100 countries, and the livelihoods of 900 million people. As indicated by UNEP, it is most severe in the arid and semi-arid farmlands of sub-Saharan Africa, where one third of the entire world area of dryland soil degradation is found.

The DMP is an ecoregional, integrated initiative which brings together national agriculture research systems (NARS) and key stakeholders from nine countries of sub-Saharan Africa, four subregional organizations, eight international agriculture research centres (IARCs), and four advanced research institutions (ARIs). ICRISAT was appointed as the convening centre of the initiative and hosts the DMP co-ordination unit. In 1997, the International Development Research Centre (IDRC) awarded the DMP 483,000 CAD to support DMP activities in three member countries – Botswana, Burkina Faso and Kenya – for a period of three years. In 2002 the Global Environment Fund (GEF) awarded the DMP US$16.0 M to cover for a period of six years. Of this total ICRISAT is to receive US$1.9 M for research and equipment of its GTs, US$1.0 M for capacity building of NARS, and US$4.9 M for co-ordination of the overall activity. Other IARCs are to receive US$1.4 M, and ARIs

US$0.9 M. The rest of the funding (55%) is for NARS in-country activities a sizeable proportion of which is research.

The goal of the DMP is to increase the food security of poor, rural populations and contribute to poverty alleviation by halting or reversing desertification. The mission is to unravel the complex causative factors of land degradation, to formulate holistic solutions and to develop integrated approaches to halt the process and reverse land degradation. The specific objectives of the GEF project are to understand the physical mechanisms of land degradation, improve dryland natural-resource management (NRM), formulate drought management strategies, promote conservation and sustainable use of biodiversity, and exchange technologies and information among countries. SROs are to be deeply involved in setting regional priorities, NARS and NGOs are expected to develop, assess, and extend suitable technologies and policy options in-country, IARCs are expected to develop and validate technologies in partnership with NARS, and ARIs are to provide strategic research inputs.

Within ICRISAT, all the GTs are expected to participate in the project. For example, GT1 is to use biotechnology tools to assess intra and inter genetic diversity and erosion, GT2 is to conduct inventories of endemic and endangered species and monitor changes in agro-biodiversity in desert margins, GT3 is expected to develop a common framework for site stratification and characterization, GT4 is to develop sustainable seed systems for conservation of endangered species, GT5 is expected to develop sustainable alternative livelihoods, enhance crop-livestock integration, and promote crop diversification, while GT6 is to be involved in diversification of income sources to conserve threatened ecosystems, etc.

Within the six years of the GEF project, outputs expected from the activities include: 1) Improved understanding of ecosystem status and dynamics with regard to loss of biodiversity; 2) Strategies for conservation, restoration and sustainable use of degraded agro ecosystems developed and implemented; 3) Capacity of stakeholders and target populations enhanced; 4) Alternative livelihood systems tested and promoted; 5) Sound policy intervention/guidelines for sustainable resource use formulated, adopted and implemented; 6) Participatory natural resources management methods implemented.

Achievements

Within the IDRC funded project, national scientists in Burkina Faso, Kenya and Botswana identified and characterized six benchmark sites. They identified and evaluated ten traditional natural resource management practices through participatory research with farmers, NGOs and local partners; and promoted improved integrated management technologies and policies through the implementation of several workshops and the publication of 5 articles and conference proceedings and 30 reports. ICRISAT claims that significant progress was made in improving the understanding of the processes that cause desertification, and the biophysical and socio-ecological conditions, which characterize the desert margins. In addition, many partnerships and networks were formed to improve the understanding of traditional natural resource management practices in the desert margins, and to facilitate the sharing of information, resources and lessons learned at the community, national, regional and international level. Activities in the GEF funded project only commenced in 2003.

Assessment

In the view of the Panel ICRISAT has adequately performed its role as the convening centre of the system-wide DMP, providing the necessary oversight and coordination, fostering partnerships among stakeholders, and facilitating fund raising.

The GEF funded DMP project warrants special attention as a partnership activity of ICRISAT. Only 12 % of the funds will go towards funding ICRISAT acquisition of equipment and research by the GTs with an additional 6% to ICRISAT's NARS capacity building activities. These, as well as the funding for other IARCs and ARIs (14%) are expected to produce IPGs. The rest of the funding is for administration and for the activities by NARS that will mainly produce NPGs. The question of the comparative advantage of ICRISAT in undertaking this activity arises, as well as the question of the efficiency of the partnership arrangements in the DMP. The Panel is satisfied that based on past experience, project management arrangements are adequate and that ICRISAT has the capacity to deliver the NARS output it is committed to delivering.

With regards to the comparative advantage of the Centre engaging in the DMP, the Panel notes that a significant proportion of the expected output of activities conducted in-country by NARS, are likely to produce regional public goods – a legitimate area of support for an IARC. However, the Panel is concerned that the project has substantial emphasis on natural biodiversity, an area for which ICRISAT has little expertise either currently or in the past and that the scope is extremely broad. ICRISAT will have to pay close attention to building and maintaining strong linkages with institutions that have a comparative advantage in this area of work.

CHAPTER 6 - PROGRAMME MANAGEMENT AND SUPPORT

6.1 Board Oversight

Among other things, the Governing Board is expected to guide and monitor the programme vision, strategy, programme content and efficiency of programme implementation and quality of outputs. To that end, the Board of ICRISAT has constituted two programme-relevant committees, the Programme Committee (PC) and the Technology Exchange Committee (TEC). Each member of the Board is active in one or the other. During Board meetings, the Programme Committee (PC) and the Technology Exchange Committee (TEC) meet separately followed by a joint meeting.

The Board of ICRISAT is supposed to have up to 15 members, including the *ex-officio* members. Since 1996, the ICRISAT Board has acted on the recommendation of the last EPMR and appointed one additional member from Africa to the Board. The Board in 2002/2003 was therefore balanced in terms of geographic representation (three members from India, three from Africa with representation from each of the relevant regions, and one from Latin America, complemented by expertise from the Japan, UK, Australia, Canada, France and the USA).

Also the disciplinary competencies were evenly spread ranging from biotech, breeding and crop management, to IPR, NRM, and policy, although socioeconomics are currently lacking. With five female Board members, the Centre has a better than usual gender balance. The BoT has seen a fairly high rate of rotation, replacing 5, 1, 4, 3, 5, 4 and 5 members each year over the past 7 years, due in part to shifts in responsibilities of host country representatives. Unfortunately, the Board renewal is not evenly spread over the years, with 5 of 14 members leaving in 2003, including the Board and Programme Committee Chairs. The large turnover in the past few years is particularly unfortunate given the challenges the Centre faces.

The Board seems to have generally good attendance and commitment to the Centre. Today, it understands its role to be one of oversight, not management, an understanding that according to a senior member of the Board had been otherwise in the recent past. From the minutes of the Board meetings of the past 5 years it is clear that the management and funding turbulence of the Centre has been a major pre-occupation. The result of this has been a fluctuation in the amount of energy the Board was able to direct towards strategic programme oversight during a time of shifting programme priorities and programme structure. As a result, CCER's were not conducted until 2000. Also, the poor communications between management were recorded in the minutes of the PC in 1998 and 1999 when they declared that they had lost oversight of programmes and demanded better information from management.

The Panel commends the Centre for making up for lost time and implementing 4 CCERs over the past 3 years. The more recent CCERs were discussed and covered in the minutes of the Board (e.g., administration and social sciences), others were primarily under the purview of the PC (NRMP-CCER).

The Panel attended two committee meetings of the Board that are relevant to programming of ICRISAT and observed the routine way of doing Board business in March 2003. Three of the six Global Themes (GTs 1, 2, and 4) were presented to the PC and TEC

during these meetings, both as PowerPoint as well as documents with the purpose of "Discussion and Guidance" by the Joint Committee. Minutes of past PC meetings reveal that the PC often offered suggestions and expressed concern regarding programme content. The Panel was impressed with the insights of the PC and TEC members and the depth and breath of questions asked and the dialogue with staff. Each of the programmes was subsequently given the tacit blessing by the Joint Committee. Neither the presentations nor the discussions in the Committees went into the resource allocation aspects of programme implementation, so that it remained unclear whether the necessary resources of funds and staff were always on hand to implement what was presented.

Although priorities within the GTs were presented and discussed, it was not clear how the broad range of activities that were presented in the various GTs fitted in the priority ranking of the overall strategy of the organization. This was not made an issue by the Joint Committee. It would be useful and appropriate if the Joint Committee would insist on reviewing the GTs in the framework of the overall strategy of the Centre, once it has been developed, before it formally gives the work plans an endorsement. The overall strategy of a Centre is embodied in a Board approved Vision and Strategic Plan. The Panel was given to understand that ICRISAT considered its brief Vision and Strategy statement to be its Strategic Plan. The Panel considers the current Vision and Strategy of limited help in guiding donors or staff. In the Panel's view the BoT should have demanded a more elaborate and concrete Vision and Strategic Plan as a basic framework for its oversight role (see also section 4.1).

The EPR Panel had an opportunity to interact with the full Board and to ask the Board some questions as to the way they perceive and discharge their duties, and their views on the issues of Asia vs. Africa balance, international public goods research, and ICRISAT's comparative advantage, and on the way the Board perceived its role in maintaining the quality of research at ICRISAT. The answers to the posed questions indicated that the issues raised by the Panel had been deliberated by the Board and that positions on these issues were not yet fixed as they had not necessarily been fully resolved. The latter is evident also from the Major Issues paper prepared by the Centre for the EPR.

Overall, the Panel considers that the Board has, in the past few years, become more effective in working with management and staff in turning the Centre around from where it was at the time of the last EPMR and the first few years thereafter.

6.2 Programme Organization and Management

6.2.1 Leadership

Leadership at the CGIAR Centres is provided at several levels. The Board provides leadership through due diligence, foresight and effective interphase with management. The senior management exercise leadership on a day-to-day basis, keeping an eye on both the shorter and the longer-term. An assessment of the leadership role of the Board is discussed in section 6.1.

The Director General serves as the lynch pin of the Centre and is responsible for fostering and sustaining an enabling environment for scientific excellence and social cohesion. In this task, the leadership qualities include diplomatic and public relations skills, and go beyond the campus boundaries in order to maintain healthy host country relationships, facilitate alliances and partnerships and cultivate donors for resource mobilization. The DG is

aided in this task by his/her deputies who have line responsibilities in their respective areas. The DG and the deputies on the scientific and administration sides constitute the senior management team at the Centre and are essentially responsible for managing the day to day business of the Centre, maintenance of morale and scientific ethos, and strategic and operational effectiveness and efficiency. On the scientific front, the senior scientists (theme leaders and project leaders) collectively carry the responsibility of leadership at the 'bench' level, and similarly on the administration front where middle level managers carry the responsibility.

Thus, the concepts of leadership and management effectiveness at a CGIAR Centre are not simple. They depend on the individual as well as the collective personalities, experience, qualifications and motives, a situation akin to corporate leadership. Managing a CGIAR Centre is therefore a formidable task at best of times, given the uncertainties of funding, vested interests and political uncertainties.

The Panel assesses the leadership qualities of the DG and management against this background. Since the last EPMR, the Centre has had to cope with an unfortunate chain of changes in leadership. Four DGs and 4 DDGs (ADG-Research) have followed each other in rapid succession since 1997. The Panel believes that ICRISAT has been most unfortunate in having to go through such instability in which the contrasting personalities of each of the four DGs and four DDGs must have added further anxieties.

Leadership, which traditionally has been extremely centralized at ICRISAT was largely devolved during the experimentation with the matrix management in the early 1990s. Following the 4th EPMR this process was reversed step-wise. In the process of changing leadership, the Centre's vision shifted substantially (see section 4.1) and its organization was completely re-structured twice (see section 6.2.2). With each change, the actions to be taken with regard to recommendations of the 4th EPMR were revisited and adjusted or reversed. This has led to an attitude in some staff of "lets wait and see what next" which the current leadership is in the process of remedying with team-building sessions, E-dialogues, and "crazy idea hours" meant to encourage staff – management dialogue. More substantially, the relatively longer tenure of the current DG has enabled ICRISAT to engage in a structured bottom up Institute-wide strategic planning process which is having a positive impact on the corporate morale and team spirit while offering hope of a new chapter in ICRISAT's history.

Under the new DG immediately after the 4th EPMR, a serious attempt was made to implement the recommendations of the Review during the period 1998-99. The sudden departure of the DG followed by an interim DG essentially led to a period of "reversal". The arrival of the current DG marked a new era in the leadership, including that at the collective senior management level. New vision and programme structures were defined while attention was directed to reconciling the political tensions within and outside the Institute. At the same time, leadership was provided to further develop the upstream biotechnology and genetic enhancement programme. The Panel believes that this achievement deserves a special recognition and commends the DG and his staff for this accomplishment.

It is the impression of the Panel that the transformation of ICRISAT has continued under the new leadership. The new programme structure involving GT leaders and regional representatives has laid a fresh foundation for a corporate leadership that is stronger, wiser and confident. The recent arrival of a DDG-Research improves the prospect of scientific leadership in the Centre.

Although the Panel conducted no formal survey, based on the staff interactions, it is of the view that given the stronger Board and greater delegation of programmatic and administrative authority, the stage appears to have been set for ICRISAT to transform further into an Institute for the 21st century. This transformation must involve further delegation of authority to the scientific leadership and staff, and the strengthening of ICRISAT's presence in Africa. From a research perspective, overall, leadership at the Centre seems to have built a credible and coherent system that should have a chance to show merit.

6.2.2 History and Structure

The organizational structure is meant to insure a smooth and effective delegation of authority and clear lines of communications between the various levels of the organization in implementing and monitoring the programme. The current programme organization has emerged from a series of restructuring efforts that took a programme-based structure to a project structure arranged in a complex matrix (1990s) back to a programme structure following the last EPMR. The former 12 Research Projects that operated under 7 disciplinary research divisions were recast into three Programmes, namely: the Genetic Resources and Enhancement Programme, the Natural Resources Management Programme, and the Socioeconomics and Policy Programme. Subsequently, a fourth programme was added in 2000 ---The Information Resource Management Programme.

The newest arrangement is based on 6 Global Themes that replaced the three principal programmes (see section 4.1) that cater to the 4 Global Impact Target Areas or GITA's. The GITA's are broadly defined, partly unconventional Target Areas providing the centre with a lot of programmatic latitude but little focus. The human resources were re-organized in GT's to define the scope and allow for the new areas of business to be taken on by the Centre. The remnants of the matrix are found in the regional programmes that each has a Regional Representative to facilitate the implementation of the agreed upon GTs. Resource allocation is done through GT coordinators that are allocating 50% of their time to this function. Scientist's time is allocated to projects within the GT's as are most of the operational resources. The Regional Representatives control and manage infrastructure. The programme reporting is also done through the GT coordinators to the DDG and up. The DDG also manages the research support services. Country Representatives report to the Regional Representatives who report directly to the DG. The DG acts as his own Regional Representative for Asia. A diagram depicting the current structure of ICRISAT is provided in chapter 1.3.

The Regional Impact Target Areas (RITA's) are currently being developed independently but following the adoption of the GITAs and are to do justice to regional stakeholder priorities. From early results it appears that there is no conflict developing between the RITA's and GITA's, but the results of this exercise have yet to be incorporated and could have consequences for the programme structure. For instance, the area of IPM/IDM might be given higher priority in the African context so that it more logically might be managed by GT3 instead of GT2. Also, the new GT4 and GT5 might need to be more fully resourced if they are to warrant the administrative overhead of a GT.

Assessment

An organizational structure should reflect the power structure of the organization. The structure of the Centre thus is significantly flattened as recommended by the 4th EPMR and should be simpler to operate. Its effectiveness will depend on the authority delegated to the GT leaders, given the complexity regional spread of their programmes. In that regard, a disproportionate fraction of the power appears based in SA where finances are centrally planned and managed. It is, for instance, unclear whether the GT3, GT4 and GT5 coordinators based in Africa would have the authority to curtail the activities in Asia if they felt that priorities should be in Africa as suggested in the 4th EPMR. In fact, given the enormous down-scaling in Africa, it appears that this is doubtful. The senior management group is entirely HQ based and meets approximately monthly, has a full institutional mandate and claims geographic impartiality in discussion. The research committee incorporates all the heads of GTs, the regional representatives in Africa, the head of project development, the head of information resources and is chaired by the DDG Research, and is thus geographically balanced. The Director General attends at his discretion. This group now meets face-to-face 3 times a year and in a virtual mode when required. Their views are fed into the Management Group decision-making process. The administration and operations committee is also entirely HQ based, meets approximately monthly and is chaired by the head of human resources and meets monthly. In that structure it is not evident that the voice of the GT leaders based in Africa can be adequately heard though Management claims it is. Part of this depends on the ease of communications, in which the Centre has made great strides (see section 6.4).

The site visit has given the Panel a taste of the problems in communicating between Africa and Asia. Despite the substantial efforts made to extend the Internet/Intranet to the regional hubs, flow of large documents is still a tedious undertaking. The African regions were in the middle of defining their RITAs (Regional Impact Target Areas), an exercise that would have been helped by easier communications with the colleagues at HQ, particularly since the staff contingent in the African regions is thinly spread

From a listing of projects proposed for funding for 2003 presented to the Panel, the degree of engagement of staff members in fundraising becomes apparent. Virtually all scientists are generating project ideas, concept notes and proposals. The opportunity costs are considerable. The projects also span a wide range of activities in Asia and Africa. The Office of Project Development and Marketing is coordinating project preparation and fund raising efforts. The degree to which project initiatives central to the strategic mission of ICRISAT are addressed through this decentralized effort remains to be seen. Nor is it self-evident from the programme structure how consensus will be reached on the protection of core competencies in order to sustainably address areas of research for which the Centre has a prime mandate

Demands from projects and regions within the Centre will undoubtedly be conflicting at times. The organizational structure would have to be suitable to implement a strategy to manage such situations. It appears that ICRISAT is aware of this and it claims that the new structure is the proper tool to avoid conflict and maximize efficiency. It remains to be proven in an institute with a skewed set of stakeholders in the different regions.

The Panel believes that the current structure is a legitimate system for a Centre of this nature and has been proven to work elsewhere, but that it cannot be evaluated at this time due to the brief track record.

6.3 Resource Allocation

The total resources available to ICRISAT during the period since the last EPMR have been US$23.00 M in 1999, US$23.35 M in 2000, US$24.10 M in 2001 and US$23.05 M in 2002. The proposed resources for 2003 are US$22.3 M and planned resources for 2004 and 2005 are US$23.0 M and US$23.6 M respectively.

The resource allocation by CGIAR logframe outputs are as follows:

- Allocations to *germplasm collection and conservation* (output 1) remained steady at about 10% over the period 1999-2002, but is proposed to decrease to 7% in 2003 and beyond.
- Allocations to *germplasm improvement* (output 2) increased from 27.5% in 1999 to about 31% in 2002 and is proposed at that level beyond 2002.
- Allocations to *sustainable production systems through INRM* (output 3) decreased from 36% in 1999 to 29% in 2002, but this is proposed to increase to about 33.5% subsequently.
- Allocation to *policy and socioeconomics* (output 4) research have fluctuated from 11% in 1999 to 18% in 2000 and down to 16% in 2001 and 2002, and falling further to some 11% during 2003-2005 period.
- Allocation to *enhancing institutions* (output 5) was at about 15% in 1999, decreasing to some 13% in 2002. It is projected to increase to 16.5% for the 2003-2005 period.

Thus, two-thirds of the total resources are directed towards logframe outputs 2 and 3. This is consistent with the primary mandate of ICRISAT. The planned decrease in the allocation to outputs 1 and 4 over the period 2003-2005 is matched by a proportionate increase in allocations to outputs 3 and 5. Although the lower allocation to output 5 is a reflection of the training activities being outsourced and tuition based.

In terms of allocations to commodities, ICRISAT directed 97% of its total resources in 2002 to its mandate commodities and the rest to livestock and trees related research. Sorghum and groundnut research received 48% of the resources, pearl millet and pigeonpea 29%, chickpea 8% and finger millet under 2%. These resources, in absolute equivalents, are generally below the levels recommended by TAC in the last priorities and strategies exercise for 1998-2000.

The proposed resource allocations to the six global themes in 2003 are: GT1 18.9%, GT2 24.4%, GT3 21.9%, GT4 13.8%, GT5 10.3% and GT6 10.8%. An assessment of these allocations in relation to the issues of critical mass of each of the global thematic programmes is provided in sections 5.1 to 5.6.

For GT1, a breakdown of resource allocation shows that it has a total budget allocation of US$2.6 M per year for the last six years (1997-2002) from unrestricted funds. This represents an average of 11.3 % of the total budget. Restricted project funds for GT1 averaged at US$0.95 M during the last two years and are expected to generate US$2.6 M in 2003.

A breakdown of resource allocation shows that the total yearly budget from unrestricted funds for Genetic Enhancement (interpreted to include all of GT2, and part of

GT3 and GT5) has remained almost steady at US$12.77 M for the last 7 years (1997-2003). This represents on the average, 56 % of the total budget. The Restricted project fund for GT2 alone averaged at US$2.5 M during the past two years and is expected to generate US$5.7 M in 2003.

The Centre's unrestricted core-funds commitment in underpinning the Natural Resource Management Programme, of which GT3 takes up the lion's part, has come down from just over US$10 M or 42% of core resources in 1997/98 to around US$7 M or 30% since. Genetic enhancement remained relatively stable at around US$12.5 M and thus captured 48% in 97/98 but now stands at nearly 60%. The trends are more severe for the unrestricted operational research funds where genetic enhancement remained steady at around 60% whereas NRM dipped from 35% to 24%. These trends suggest that the Centre has attempted to protect the areas in which it has the better track record (chapter 2 and 3). The restricted funds mobilized by GT3 stood at US$2.8 M in 2001, US$2.4 M in 2002 and are projected at US$1.9 M in 2003.

For GT4, a breakdown of resource allocation shows that it has a total budget allocation of US$2.4-3.5 M per year from unrestricted funds. This represents 11-17% of the total budget almost equivalent to the budget allocated for biotechnology and socioeconomics. GT4 has raised approximately US$2.5 M during the last two years and is expected to generate US$3.2 M in 2003. It appears that at least during the past two years, 50% of the total resources of GT4 came from core and 50% from restricted fund sources.

For 2002, GT5 was allocated US$2.4 M of which US$0.12 M (5%) was restricted project funds. For 2003, of the planned resources of US$2.3 M allocated to GT5, US$0.54 M (24%) are restricted project funds. It would appear that the bulk of the resources for GT5 are from unrestricted sources.

For GT6, the allocation for year 2002 was US$2.5 M and for 2003 it is US$2.4 M. In 2002, US$0.34 M (14%) and in 2003 US$0.33 M (14%) are from restricted project funds.

According to ICRISAT 2003-2005 MTP, the allocation of resources to Africa and Asia has been 49% and 51% respectively in 2001/2002, and is projected to increase to 52% for Africa and decrease to 48% for Asia in 2004/2005. It is not clear how the regional resource allocations are quantified by ICRISAT. The Panel is aware that ICRISAT considers that a portion of the strategic research in germplasm enhancement and NRM based at Patancheru is relevant to Africa, Thus, some of the resources actually spent in Patancheru are cost-assigned to Africa. On the other hand, the actual staff deployment figures in 2002 alone suggest that probably more than 60% (and not 51% as assumed by ICRISAT) of the actual resources were allocated to Asia.

ICRISAT's unrestricted resources have seen a significant drop during the review period from 62.4% in 1999 to 40.7% in 2002, and is expected to decrease further to some 30% during the MTP 2003-2005 period. This is in line with the trend in the CGIAR System where unrestricted resources decreased from 51% in 1999 to 37% in 2002, and the trend is expected to continue. Serious concerns are being registered by CBC/CDC/Centres and iSC regarding the negative impact of less than optimal level of unrestricted funding on science quality and innovativeness and programme effectiveness.

Until 2001, ICRISAT operated a Resource Mobilization Office (RMO) as part of the DG's office. In 2002, the Institute set up a Project Development and Marketing Office (PDMO), combining RMO and Public Awareness functions. PDMO is dedicated full-time to resource mobilization for ICRISAT's programmes. However, it is not clear how PDMO can contribute to mitigating the negative consequences of the dwindling unrestricted resources. There does not appear to be an Institute-wide resource mobilization strategy that is consistent with the needs of the different regional programmes. The three regional hubs in Africa appear to be mobilizing resources very much on their own, and most of the staff there who were interviewed by the Panel pointed to the fact that they were working mainly or entirely with "soft" money, with little help from the Headquarters.

The Panel is of the view that the management and Board should assess the operational and programmatic implications of managing the Institute in a future with less than 30% unrestricted funding. Such an assessment should aim at providing strategic guidelines for resource mobilization activities of PDMO in line with the planned research agenda, and consistent with ICRISAT's comparative advantage and goals. Such an assessment would also contribute to fostering greater transparency in the linkage between the Research and Finance Divisions.

6.4 Information and Communication

At the time of the last EPMR, there existed several nodes of independent activity in support of research, though some worked closely together: computer services, GIS, modeling, statistics, electronic publishing and library. Due to this fragmentation, management's control over procurement of computer systems seemed to have been deficient. Also, the Panel expressed serious concern that there seemed to be no Institute-wide policies for documentation, maintenance and retrieval of research data. As a result, research data were not always handed over when a scientist left the institution, thus jeopardizing the possibility of further analysis of these data sets and increasing the risk of valuable data being lost. To avoid recurrence of such problems and to improve overall coordination, ICRISAT organized Computer Services as an Institute-wide Programme, with a Computer Services Policy and Review Committee created and chaired by the Assistant Director General, with the Head of Computer Services at Patancheru serving as Secretary to the Committee. The Panel suggested inter *alia* that the Board should commission a CCER on information management, and that ICRISAT may want to consider appointing a manager for all information services.

Subsequent to the EPMR, a programmatic structure was adopted by the Institute in 1998 which included an Information Resource Management Programme (IRMP) which was made up of four Units, namely: Information Technology (ITU), Public Awareness Office (PAO), Training and Fellowships Programme (TAFP), and the Library and Documentation Services (LDS). The last two were integrated into a Learning Systems Unit (LSU) in 2000.[4] Under the current organizational structure, IRMP has been transformed into the Information Resource Management Office (IRMO) as of January 2002, and PAO was transferred under the Office of the DG for better operational integration with the Resource Mobilization Office. IRMO, aside from performing support service to research, maintains the IRMP's proactive

[4] The CCER on Information Resources Management states that in 1999 ICRISAT Created a new Division named as the Partnership and Information Management Division (PIMD). The new Division with a mandate for knowledge management consolidated into the Institute's information related units, earlier dispersed over a number of different groups in the Institute.

and development-oriented mandate, and views itself as ICRISAT's main facilitator for technology exchange together with the six global research themes and partners.

The 1999 CCER on Information Resources Management and Partnership did not address the fundamental question of the longer-term information management strategy as it was not part of the terms of reference. Instead, it examined a mixed set of information management activities of varying levels of importance. The key message from the CCER was that information and knowledge management should be a major strength at ICRISAT, with a programme status. IT must be included in this reorganized Programme because IT has to be mission-led, not technology-led. It recommended strengthening competency in knowledge management; establishment of IRMP (now IRMO); integrating LSU as a unit of IRMO; appointment of a Programme Director (now Head, IRMO); computerization of ICRISAT; establishment of an e-library; re-engineering the training strategy; and improve connectivity across locations.

At the February 2000 Board meeting, the report from TEC on the CCER was adopted, and provided guidance to management. At the September 2000 TEC meeting, the management presented the strategies for partnership, training and education and public awareness, and an action plan for Information Technology. TEC endorsed the focus on "learning" instead of training, and called for mechanisms for information diffusion for achieving impact. A report on an update on the implementation process for learning systems was considered at the October 2001 meeting. ICRISAT proposed to shift training towards e-learning and distance learning approaches. At that meeting an operational framework for information management was discussed which led to the IRMP being transformed into the proposed IRMO in January 2002. The operational framework focused on strengthening research-extension-farmer linkages in the SAT based on communication of information on agricultural innovations, and technology-based knowledge and advice to promote learning, action and capacity building.

The activities under IRMO are implemented through three units, namely: Learning Systems (training), Information Systems and Library and Documentation.

The Learning Systems Unit undertakes its work with scientists from ICRISAT, universities and the private sector in three modes: scholarly studies; joint project attachments, and specialized training courses. In scholarly studies, M.Sc. and Ph.D. students do their thesis research at an ICRISAT location while completing their course work at a recognized university, either in a developing country or developed country. Joint project attachment provides learning opportunities for universities scientists as research fellows or apprentices. Specialized training courses develop knowledge and skills of participants on new technologies, research methodologies, research management, and other contemporary topics. Recently, IRMO began reviving the Institutes' in-house training at Patancheru in collaboration with a private partner.

The Information Systems Unit in collaboration with the Learning Systems Unit launched a Computer Based Training programme of knowledge sharing through the establishment of community information hubs in the rural areas, where para-professionals are trained to mediate information flows between rural residents and sources of knowledge, The first set of pilot hubs have been set up in the State of Andra Pradesh in collaboration with the State Government as part of the watershed and livelihoods project .

Similarly, IRMO has embarked on a pilot computer-based distance learning initiative on coping with drought in a drought stricken village of Addakal in Andhra Pradesh, undertaken in collaboration with the Canada-based Commonwealth of Learning, BR Ambekar Open University and two ICAR institutes. In addition to providing information, ICRISAT aims to understand how such information delivered at the right time can help rural communities enhance their capacity to cope better with drought.

The Library and Documentation Unit continues to strengthen its collection of information along ICRISAT's research themes. At the same time, the facility to access the e-library from distant and remote locations has been extended during 2002 to locations in Africa.

The **Virtual University for the Semi-Arid Tropics (VUSAT)** for Asia was launched in India in June 2003 by ICRISAT together with the MS Swaminathan Research Foundation. The plan for the VUSAT initiative was approved by the Board in March 2003. This multi-agency coalition for the Virtual University is made up of major open universities in South Asia, state governments, and advanced research institutes dealing with climate management. According to ICRISAT and IRMO senior management, the VUSAT aims to develop climate literacy and drought preparedness among rural communities, development workers, service providers, policy makers and other strategic sectors through the integrated use of ICT, open distance-learning, and other communication media. The Virtual University also expects to test the effectiveness of new tools (e.g., space technology, the Internet, satellite-based tracking of ground events in hydrology etc) in communication and learning.

The vision driving the VUSAT initiative is more than drought preparedness, mitigation and response. It is described as "Reaching the unreached; voicing the voiceless in the semi-arid tropics". The mission is "Empowering SAT communities with information, knowledge and skills to enhance their farm productivity and sustainability". The nature and concept of VUSAT is described as "A virtual mass-based education, training and communication institution, offering life-long learning opportunities to the poor, complementing and supplementing open distance learning initiatives in agriculture". The objectives are to: "Educate and train a wide array of stakeholders in the dry tropics; communicate relevant information for community mobilization; establish and sustain a virtual network of policy makers, researchers, educators, service providers and farm communities". The envisaged initial geographical scope of VUSAT is to cover South Asia and sub-Saharan Africa.

The **Communication** system has been considerably upgraded in terms of the quality of infrastructure and institute-wide connectivity. All the regional hubs and major locations of ICRISAT in Africa have been provided with dedicated connectivity to the Internet. The global Intranet facility allows ICRISAT as a whole to maintain contact on a real time basis. This is permitting the regular exchange of news throughout the ICRISAT network, and key administrative and policy information is accessible to ICRISAT staff through secure web pages irrespective of location.

Assessment

The core business of ICRISAT is to generate and disseminate information products, knowledge and technologies. In any international research institution, information is a dynamic concept and must be managed in the most advanced state-of-the-art manner. It is an

input as well as an output in the research process, and it is generated, transmitted, stored, exchanged, modified, transferred and disseminated within the knowledge system along the Research to Development Continuum. Training is a means of transferring information, knowledge, skills and tools. Overall, the Panel believes that ICRISAT strategic framework for information management and learning has evolved effectively and is beginning to pay dividends. The Board minutes show that serious attention was paid to guide the evolution of the information and ICT-related functions and objectives of ICRISAT, and the Institute has responded in a committed and effective manner to the key recommendations of the 1999 CCER.

ICRISAT is part of the global knowledge system on all aspects of SAT agriculture in which its main preoccupation is the generation and dissemination of new information. Thus ICRISAT's emphasis on learning, information access and reaching remote rural areas is laudable. Advances in ICTs will continue to have a direct influence on the relevance and quality of research at the Centres as well as on how information can be accessed by clients, users and ultimate beneficiaries. The Panel commends ICRISAT for taking advantage of the opportunities arising from advances in ICT for upgrading its communications infrastructure for connectivity, networking, knowledge exchange, library access, learning and capacity building. ICRISAT is particularly commended for piloting the ICT-based open distance learning initiatives, including those covering poor inaccessible rural communities for drought management. ICRISAT must ensure that the IPG research value of this experiment is effectively managed, and generic lessons for success are identified for sustained large-scale impact.

The Panel believes that ICRISAT must be clear about its role and scope in promoting and operating ICT-enabled distance learning initiatives. Undertaking research on the efficacy of ICT-based distance learning for vulnerable rural communities, for example, for anticipatory action on drought could be justified if the aim is to generate outcome and impact-oriented IPGs.

The Panel seriously questions ICRISAT's comparative advantage in operating a distance learning initiative of the type and scope embodied in the VUSAT. Such institutions are the core business of national research and education systems. The VUSAT initiative, although of high public relations value and visibility, will demand significant long-term resource commitments and attention. The Panel is concerned that no serious thought appears to have been given to the legal implications of setting up VUSAT or to oversight and quality control or to the roles and responsibilities of the coalition members. The Institute should undertake serious assessment and deliberations on the legal implications of setting up VUSAT. In theory, ICRISAT could provide the initial catalytic help to get the initiative off the ground but take a back seat role subsequently. No such strategy has been proposed by ICRISAT. The Institute should be more explicit about its short and longer-term role and its overall strategy in coordinating the VUSAT coalition.

The Panel is also particularly concerned that a terminology specific to tertiary education, i.e., "university" has been used for an activity far removed from tertiary education. ICRISAT management contends that the name is not an important element of the initiative, and that it had been suggested by the coalition. The Panel finds this explanation somewhat wanting for substance and foresight, and finds the use of the term "university" inappropriate and confusing. Also, the fact that no charter exists for the university is not a matter of concern to ICRISAT management, yet it should be.

In the light of the above and before hopes are raised and major investments of funds, personnel and attention are directed by ICRISAT:

The Panel recommends that ICRISAT should rationalize the role, scope and objectives of the Institute in the distance learning for farmers initiative called the Virtual University for the SAT and provide management with clear guidance on where the limits of ICRISAT's interest lie consistent with its comparative advantage in IPG research. Further, the term University should be replaced with a more appropriate term such as "Virtual Learning Centre for the SAT".

6.5 Physical Facilities

Since the vision and strategy of ICRISAT to 2010 would involve greater investment in research and development in sub-Saharan Africa than South Asia compared with the past, we examined the physical facilities available to ICRISAT to support their activities in these regions. A Centre Commissioned External Review (CCER) on the Functions – Administration, Finance, Human Resources and Operations of ICRISAT that was published in 2001 provides some information on the physical facilities.

In South Asia, ICRISAT has the large Patancheru campus in India with a total area of 1390 ha. The campus has all of the necessary facilities for an international agricultural research centre, including, 800 ha of arable land and 65 ha devoted to extensive research laboratories with a new biotechnology facility, the gene bank, offices, conference rooms, greenhouses, houses, and dormitories and canteens. The main problem confronting ICRISAT is to develop additional uses for these extensive facilities involving partners to achieve efficiencies by cost sharing and renting, and ICRISAT is taking steps to do this.

In sub-Saharan Africa, ICRISAT currently has three sets of physical facilities where research can be conducted: the ICRISAT Sahelian Centre (ISC), Sadore, Niger; the ICRISAT Samanko Research Station near Bamako, Mali; and the Bulawayo Campus at Matopos, Zimbabwe. In addition, ICRISAT had built a research facility some 55 km south of Kano, Nigeria in 1997. This facility consists of a 30 ha farm and 10 ha for buildings and laboratories. This research station was closed down two years later in December 1999 and handed over to the state government but currently is not being used for research.

The ISC is a comprehensive research centre that was inaugurated in 1990 on a 500 ha site at Sadore, 45 km from Niamey, the capital of Niger. The low rainfall and sandy soil at ISC are typical of major pearl millet producing areas of the Sahelian zone of the SAT. The site has 3500 sq. m of buildings, including, laboratories, a gene bank, offices and houses, and 600 sq. m of greenhouses. Some 80 ha of irrigable land is available for research. The ISC also owns and operates a residential Training and Visitors' Centre in Niamey that has 16 rooms, a dining facility and clubhouse with a swimming pool and recreational facilities. In earlier years, as many as 164 staff (7 IRS and 157 NRS) have worked at ISC. However, as a result of a significant reduction in funding in 1996/97, a decision was made to consolidate programmes previously carried out at ISC into the Samanko Research Station in Mali, and to consider closing down ISC. This decision was reversed recently partly because of funds mobilized by the Desert Margins Programme and several staff have been moved back to ISC which now has 6 IRS on site.

The Samanko Research Station was formally inaugurated in 1991 on a 124 ha site that is 35 km from Bamako the capital of Mali. The research station has laboratories, glasshouses and offices but no housing with most IRS living in Bamako. This site is in the Sudan Savanna zone of the SAT, has more rainfall than ISC and is more suitable for rainfed production of sorghum and groundnut than is ISC. In 1998, this station was designated as the main centre for ICRISAT research in West Africa and this was followed by an increase in the number of ICRISAT scientific staff. Recently, some ICRISAT scientists have been moved to ISC and now there remain 2 IRS ICRISAT positions and 2 ICRISAT/CIRAD positions at Samanko. Several research scientists and support staff from WARDA (about 18 IRS and 42 support staff) who were driven out of Ivory Coast by the civil war have been provided space for research at the Samanko Research Station, and some scientists from ILRI and ICRAF also use the station.

The ICRISAT Bulawayo campus was constructed on land in the SAT provided by the Zimbabwe Matopos Experiment Station about 30 km from Bulawayo in 1984. The campus has laboratories, offices, administrative buildings, a gene bank, glasshouses and 32 houses for NRS. ICRISAT also has 13 houses for IRS in Bulawayo. In 1999, the decision was taken to make the station the focused ICRISAT site for SAT research in southern Africa, primarily for breeding and agronomy with pearl millet and sorghum. ICRISAT has four experimental farms in Zimbabwe: 50 ha at Matopos; 18 ha at Lucydale which is 15 km to the south of the campus; 13 ha at Aisleby which is 45 km to the north of the campus; and about 5 ha at Muzarabani in the Zambezi valley 160 km north of Harare. Despite a worsening Zimbabwean political and economic environment, through good partnerships ICRISAT staff have managed to maintain on-farm activities and meet all project obligations. A USAID grant that provided much of the funding for the construction, operation and research of this campus for about 20 years (Sorghum and Millet Improvement Programme or SMIP) is due to end on September 14th, 2003. In recent years the SMIP expenditure rate has averaged about US$900 000 per year. Four of the 9 long-term IRS at the ICRISAT-Bulawayo campus are wholly or partially supported by the SMIP and no other significant funds are available to support these programmes at this time. Critical problems that must be resolved by ICRISAT include the following questions. Who will own the immovable assets on the campus (e.g. offices, laboratories and staff housing) once the USAID grant expires? Where will future financial support for the ICRISAT-Bulawayo campus come from and will it come soon enough to prevent loss of experienced IRS and the momentum of ICRISAT activity in southern Africa?

CHAPTER 7 - ICRISAT IN THE FUTURE

7.1 ICRISAT Today

For more than 30 years, ICRISAT has continuously served the people of the SAT through delivery of improved cultivars of its five mandate crops derived from yield-enhancing germplasm improvement complemented by NRM research. Since 1997, ICRISAT's research programme and structure have undergone several transformations with ensuing changes in programme focus and balance between Africa and Asia. These changes were due in part to the CGIAR-wide structural reform and the SAT future scenarios. In 2002, the programmatic structure was changed into a thematic organization and management structure. Independent of these changes, there was a continued decline of unrestricted funds, which severely affected the resource allocations of the different research programmes, particularly in Africa. Despite the difficulties and uncertainties encountered during the period of this review, ICRISAT's scientists and staff have remained committed and have shown that it is possible to conduct quality research and find innovative means to deliver ICRISAT products to their partners for eventual use by farmers and the larger community.

After a thorough review of ICRISAT's research portfolio, the Panel concludes that ICRISAT has continued its excellence in science with very good programmes in genetic resources, crop improvement, and biotechnology. It has maintained its world-class core competency in genetic resources and enhancement of SAT crops by exploiting the tools of biotechnology and IT to produce varieties, new tools, methodologies and other international public goods. While ICRISAT's publication output suggests that its scientists are reasonably productive and an adequate proportion of their work has been deemed of acceptable standard by the global scientific community, the contributions from some global research themes have been less than optimal. ICRISAT is conscious of this and is examining fresh approaches to remedy the problem. Evidence in support of these conclusions comes from the evaluation of the quality of ICRISAT's research, outputs and staff; meetings with scientists and staff; site visits; discussions with NARS representatives from India and ICRISAT's host country representatives in SAT Africa; and other partners from the international public institutions, the private sector and farm communities.

ICRISAT and its many partners have made significant achievements that are already having discernible impacts, some even at the farm level. Notable of these are: (1) two path-breaking research programmes on pigeonpea and chickpea that led to the commercialization of these subsistence crops and merited for ICRISAT, the King Baudouin Award of the CGIAR on two occasions; (2) high-yielding and pest resistant intermediate products and varieties of its five mandate crops released to a wider range of partners and regions; (3) core collections of well-characterized germplasm of the five mandate crops; (4) new biotechnology tools, methods and products including genome databases, transgenic lines and diagnostic kits for aflatoxin detection; (5) development of IPM for pod borer control in pigeonpea and chickpea; (6) documentation of the impacts of ICRISAT's technology and priority setting; (7) re-designing of emergency seed distribution systems and revised seed approaches to seed marketing in southern Africa; and (8) an ICT-based information platform for Institute-wide knowledge sharing and management and distance learning initiatives.

The Panel notes that ICRISAT places a high degree of importance on partnership building activities. ICRISAT's research is conducted in collaboration with a large number and

diverse array of partners that include ARIs, CGIAR Centres, NARS, NGOs, the private sector, rural communities, etc. It has established several mechanisms for partnerships including networks, which have been used effectively to facilitate technology transfer and strengthen the research capacity of the NARS to produce NPGs from IPGs generated by ICRISAT. Overall, ICRISAT's partners have expressed satisfaction in the extent and quality of these partnerships. The Panel commends ICRISAT for its genuine efforts to develop appropriate partnerships to carry out its research goals and objectives.

The Panel notes a number of areas both in programme research and management that need to be addressed. The need to: (1) complete the evolution and operational integration of the commodity programmes at ICRISAT, Patancheru into a global strategic germplasm enhancement research programme; (2) address pressing issues on Intellectual Property, biosafety and public acceptance for transgenics; 3) increase capacity and resources in Africa to maximize the comparative advantage of strategic NRM research; (4) implement fully the CCER recommendations for SEPP at ICRISAT; (5) rationalize the role, scope and objectives of ICRISAT in the VUSAT initiative; (6) set and document research agenda and priorities through a transparent and highly participatory process; and (7) provide stronger day-to-day management and leadership of research programmes. The Panel believes that the current programme structure (Global Themes, Global and Regional Impact Targets) is a legitimate system for a complex institution like ICRISAT, but it needs to be more clearly delineated.

The Panel concludes that ICRISAT, more than ever, deserves the continuing and enhanced support by the donor community as it charts new grounds in the future.

7.2 ICRISAT in the Future

7.2.1 Challenges and Opportunities

ICRISAT today is faced with a number of challenges and opportunities for its work in the Semi-Arid Tropics. These have been analysed by ICRISAT in *Future challenges and opportunities for Agriculture R&D in the Semi-Arid Tropics* and *ICRISAT's Vision and Strategy to 2010*.

The Human and Natural Resources Environment

Population growth rates are declining in the developing world, but even with growing urbanization, the challenges of poverty, food insecurity and malnutrition will continue to be greatest in the rural SAT. Agricultural productivity must be increased in order to transform the lives of millions of the poorest people who live in the SAT.

There are changes in agricultural productivity and production patterns. In the rural SAT, staple cereals are consumed locally and are a major source of energy. In South Asia, the level of production of sorghum and pearl millet has been maintained and increases in productivity have released land for diversification into higher value crops. In West Africa, however, yields have stagnated because genetic yield gains are substantially constrained by natural resource limitations.

Demand for animal products (meat, milk and eggs) in developing countries is growing rapidly which has led to a growing demand for sorghum and pearl millet as dual-purpose varieties (crop residues and feed grain). In addition, industrial uses for coarse grains (e.g.,

starch and alcohol) and opportunities for processing are growing rapidly. Sorghum and millet can be further used by the industrial and animal feed sectors in the SAT if quality of the products is improved.

Today, more than ever, the world faces even greater challenges in managing the natural resource base and achieving food security. The SAT is a harsh, risk-prone, fragile environment. Drought is a constant threat. Water scarcity is a growing problem. Soils are poor and land degradation is increasing. Risks are pervasive and greater than in any other food production environment.

The poor in the SAT face variable and unpredictable risks. Their ability to invest in technologies is both constrained and dynamic. The devastating effects of HIV/AIDS on household income and food security and the feminization of agriculture, especially in sub-Saharan Africa, demand innovative solutions.

Growing commercialization in the SAT is leading to increased market opportunities and trade in SAT crops for poor smallholder farmers. Increased utilization of coarse grains in the SAT is inextricably linked with the fortunes of the market, the role of the private sector and technical and policy factors that determine the behaviour of these institutions.

The Research Environment

The environment in which ICRISAT operates has changed dramatically over the past 20 years. Publicly funded agricultural research has declined by over 50 percent during the past 15 years. An increasing share of agricultural research and ownership of new technologies has moved to the private sector. Environmental considerations are increasingly integrated into international development policy.

The total resources available to ICRISAT over the last five years have declined dramatically from US$30 M in 1996 to US$21 M in 2002. The proportion from unrestricted sources has also declined significantly from about 62% in 1999 to 40% in 2002. The proportion is expected to decrease further to under 30% in the 2003 – 2005 period. Increased dependence on restricted funds forces research managers and scientists to think more about donor priorities and development opportunities, and partner more closely with other stakeholders to solve mutual problems.

The CGIAR's Vision and Strategy 2010 articulates the new vision: *a food secure world for all.* The goal is to reduce poverty, hunger and malnutrition. Its strategy is embodied in seven core planks, which together guide the ICRISAT's new Vision and Strategy to 2010.

With the advent of biotechnology, various legal, financial and political constraints are evolving that constrain the exchange, delivery and use of germplasm and cultivars which has been a major activity of ICRISAT. Similar constraints arise as Centres form partnerships with commercial seed companies.

Opportunities

As indicated earlier, the Panel believes that ICRISAT today has clear comparative advantage in research in a number of areas: 1) Developing, maintaining, and enhancing the use of germplasm collections of its mandate crop species. 2) Breeding enhanced germplasm

and, in the short term improved varieties in some cases, and developing improved breeding methods for its mandate crop species. 3) Developing improved rainfed cropping, and integrated cropping and livestock systems for the SAT in sub-Saharan Africa that include its mandate crop species and consideration of larger-scale aspects of NRM, such as enhanced watershed and agro-ecosystem management. 4) Analysis of institutions, policy, commercialization of seed systems and the marketing of ICRISAT mandate crops. 5) Generating data and analysis of the evolution of rural communities in the SAT. These provide a unique opportunity that the Centre has an obligation to the CGIAR and the rural people of the SAT to exploit.

The ongoing biotechnology revolution provides new opportunities for making plant breeding more effective and more efficient. The strengthening of NARS will provide better and more opportunities for ICRISAT to form effective partnerships with them in pursuing biotechnological solutions to problems. Strengthening of the commercial seed industries also will provide new and different opportunities concerning partnerships with ICRISAT in strategic plant breeding. These opportunities already have been occurring in India and to a lesser extent in sub-Saharan Africa.

The ongoing information technology revolution provides new opportunities for extending information and capacity building. It also complements the biotechnology revolution, such as by enhancing ability to do genomics. The information technology revolution can substantially enhance opportunities for research in many other areas pursued by ICRISAT, such as simulation modeling.

7.2.2 Focus and Operational Mandate

ICRISAT should focus on exploiting its comparative advantages within the confines of its external and internal environment.

One of the most promising areas for ICRISAT to produce IPGs and continue its outstanding record of providing germplasm of the future is through the full deployment of its biotechnology competence. Though young in its establishment, the Centre has shown that it can quickly claim a front seat in this competitive arena. The mandate crops of the SAT are of limited interest to international players and are given little attention by the commercial biotech companies. Yet, the ability to react to threats from pests or diseases with agility and use these technologies to quickly transfer resistance into adapted backgrounds is a true safety valve for the SAT farmers. Moreover, major challenges to ICRISAT remain in unlocking of the genetic resources for the enhancement of their breeding materials in order to deal with abiotic stress such as drought, nutrient stress, or to ameliorate nutritive value through fortification. Here also, the biotechnology competence of ICRISAT can generate IPGs that can subsequently be brought into the proper background.

The development of a centre of excellence for plant genetic resources and enhancement (PGRE) for mandate crops in the SAT, in close partnership with the national system in India and fully utilizing the unique capabilities of the IT and HiTech communities in Hyderabad would be a facility of enormous value to all institutes that try to tackle these challenges. There may be real economies of scale if this effort was combined with those of the other Centre in the system that deals with such issues in dry areas e.g., ICARDA.

In contrast to the many NARS in Asia, the capability of a large number of countries in the African SAT to develop strategies and technologies in order to utilize their natural resource base without destroying it is severely stretched. The natural resources in the SAT are not only threatened by global climate change but also by the effects of land use conversion in the more humid parts of Africa. The challenge is to study these complex issues that aim at efficiency of land, soil, water and agro-biodiversity use at a landscape level. Such studies fall squarely within the mandate of an IARC. The aim would be to mitigate the effects of environmental degradation (loss of biodiversity, degradation of lands) by improving the stewardship of land by farmers. It would logically be done in a programme that combines the competencies of the resource inventory/processes scientists with those that will tailor the farming/cropping systems, the principal tool of the farmer, to the land. Systems studies cannot be restricted to the traditional cropping systems in which ICRISAT has gained substantial experience. The principles of integrating non-mandate crops, the development of integrated crop-livestock, agro-forestry and small-scale irrigation systems should also be studied. This should be done in partnership with other CGIAR Centres without relinquishing the responsibility of serving the SAT farmer.

7.2.3 Transforming ICRISAT – A Forward Looking Strategy

ICRISAT must pragmatically respond to the changes in its external and internal environment if it is to fully live up to the aspirations of its founding fathers and stakeholders. It must strive to remain a world class international research centre under more challenging conditions than it has ever faced in its 30 years of existence. As detailed in earlier sections of this report, and in the reports of previous EPMRs, the Centre has made significant and praiseworthy contributions to knowledge about problems of agricultural development in the SAT. This has been particularly the case for the Asian SAT. ICRISAT should be justifiably proud that it has played such an important role in the progress Asia has made over the past two decades.

The Panel takes note of the rapidly changing research environment in Asia. It is also conscious of the fact that hundreds of millions of the world's poor are still living in the Asian SAT. However, as pointed out earlier, this is now a region of major economic and technological advances, with the major SAT country India, having the World's second largest agricultural research community. The Panel believes that a traditional IARC, such as ICRISAT, can only make limited additional contributions to the generation of knowledge in the Asian SAT. National governments or regional bodies are able and should be encouraged to take over this role. The Panel therefore sees a continuing role for ICRISAT in the Asian SAT only in strategic plant genetic resources and enhancement (PGRE) for the mandate crops. Because of its excellent facilities at Patancheru, the experience of its staff, and the location in Hyderabad, the fastest growing Cyber City in the World, the Centre still has a comparative advantage in this area of research. It is important that any such effort should be embedded in strong partnerships with NARS, the private sector, and other stakeholders in order to exploit the economies of scale of a single, comprehensive strategic PGRE programme located in Patancheru.

At the same time it is very clear that it is in the African SAT that the Centre still has wide scope for generating IPGs, and maintains clear comparative advantage in many areas of research. ICRISAT must find a way of accomplishing the same successes in Africa as it has achieved in Asia. For that to happen it needs to better define its longer-term role in SSA and

must build on the fact that SSA is the region where it can have major impacts on development through the delivery of IPGs during the next decade.

ICRISAT today does not have the resources and critical mass of staff to mount comprehensive, cost effective programmes in all the regions of the SAT. In fact, with the recent retrenchments in SSA, the core commitment of the Institute to Africa is not adequate. In the struggle for dwindling financial resources the Africa presence is losing out. Business as usual - keeping full operational mandates in Africa and Asia - is therefore not realistic. In the current financial environment the cost of maintaining the Centre's entire Patancheru infrastructure will be an increasing burden. The Panel considers the possibility of drastically increased funding that would enable ICRISAT to operate a world class PGRE programme, at the same time as a full fledged NRM and socioeconomics research programme in the Asian SAT, in addition to comprehensive programmes in the African SAT, as unrealistic.

The Panel considers the efforts so far to transfer the NRM programme of ICRISAT to Africa as recommended by the 4th EPMR as unfinished business (see section 1.4). We also believe that even a significant part of the conventional plant breeding capability should be re-deployed to Africa. However, since a world class PGRE programme in Hyderabad would require more staff than currently exist in ICRISAT, the transfer of conventional breeders to Africa would necessitate replacement by highly competent regionally or nationally recruited or seconded Asian scientists.

The Panel also considered the option of splitting the Centre into two autonomous Centres with regional mandates. In such a case it is likely that the conventional ODA donor community would strengthen the African Centre. The Asian PGRE Centre would be more likely to become a national programme with some support from the private sector. However, as convincingly argued by the 4th EPMR, this is an undesirable option as it might weaken the African Centre in that it would no longer have the strategic backstopping of the germplasm collection, facilities and capabilities that might be crucial to generate breakthroughs.

In the Panel's view, the most desirable option is a win-win situation in which the African programmes of ICRISAT would be significantly strengthened while at the same time as a strategic PGRE research with a global perspective, serving ICRISAT in Africa and the NARS in Asia is maintained.

The Panel recommends that ICRISAT should rapidly restructure its programmes and transfer its Headquarters, and all programmes except its strategic plant genetic resources and enhancement programme, to sub-Saharan Africa.

This could be accomplished as follows:

1) Move the ICRISAT HQ to SSA and build an Integrated Genetic and Natural Resource Management programme that has critical mass by re-deploying human and financial resources to SSA. There is a major advantage in having the ICRISAT headquarters in the area in which it has its future primary role.

2) Maintain a core staff at ICRISAT, Patancheru for strategic plant genetic resources and enhancement, using biotechnology, wide crossing, conventional hybridization and selection to develop enhanced germplasm and improved breeding methods for

the mandate crop species. This core should have the critical mass needed to generate IPGs[5] and would be strategically and formally linked to the NARS and regional organizations. Partnerships with ARIs, private companies etc would be exploited to expand funding. The ICRISAT Gene bank would remain in Patancheru. The biotechnology effort would be maintained in Nairobi, Kenya to link the activities of the PGRE programme in ICRISAT with NARS plant breeding programmes in Africa.

3) Reduce the commitment in physical facility maintenance at Patancheru while maintaining control only over the parts needed for the activities of the PGRE programme and the Gene Bank. A gradual exit strategy will have to be developed that is based on the needs of the ICRISAT programme remaining in Patancheru. The Panel anticipates that substantial savings could be made in maintenance cost by shedding some of the Patancheru infrastructure. These could be used in acquiring and/or maintaining suitable infrastructure in SSA.

[5] The number of scientific staff (people with Ph.Ds) position equivalents in GT2 is 16.5 with 6.1 in Africa and 10.4 in Asia, which includes 3.1 working on IPM and IDM in Asia whose activities were discussed by the Panel under GT3. The number of support staff in GT2 is 29.6 with 12.3 in Africa and 17.3 in Asia, with about 5 of them working on IPM and IDM in Asia. Achieving the recommended plant breeding and associated activities under GT2 that we proposed for Africa would require increases of 3 to 4 scientific positions in Africa to give a total of about 10. The proposed Strategic PGRE programme in Patancheru would require about 4 to 6 of the scientific positions in GT2 including that of the Director of the Genebank together with the GT1 positions, some of whom may be regionally or nationally recruited scientists. As is discussed in section 5.3 the Panel recommends that the 3 position equivalents in GT2 working on IPM and IDM in Asia would be transferred to work on IMP and IDM in Africa under GT3.

ACKNOWLEDGEMENTS

The members of the External Programme Review Panel wish to express their sincere appreciation to the Board, management and staff of ICRISAT for their full and cordial cooperation throughout the review. The Panel is particularly thankful for their constructive and open attitude, and for their generous time and help given whenever requested.

Ms Martha Stone, the outgoing Board Chair and Dr Uzo Mokwunye, the incoming Chair, Dr William Dar, Director General, Dr Dyno Keatinge, Deputy Director General (Research), and Dr Cynthia Bantilan, Chair of the ICRISAT External Review Task Force fully cooperated with the iSC Secretariat throughout the Review, from its planning stage to completion of this report. They deserve our special thanks for this and for ensuring that our work could be done efficiently.

The arrangements made for our visits to the HQ and to the subregional locations in Africa were excellent. We appreciated the briefings and support received from ICRISAT staff during our country and field visits. We express our special thanks to the Regional Representatives Drs. Geoff Heinrich, Said Silim, and Saidou Koala and the regional teams in Africa for the frank and stimulating discussions.

We are pleased to acknowledge with grateful thanks the help received from several of the staff of ICRISAT during the course of the review. We are particularly thankful to Mr V. Balji, Ms Rama Gururaj, Mr G. Chandraiah and Mr Edward Joseph from the Computer Services for maintaining our computers and networking arrangements in excellent order; and to Mr K. Ravi Shankar, Senior Manager, Housing and Food Services, and his staff for ensuring that all our basic human needs were fully met. We express our particular thanks to Ms C.Geetha, Manager in the DG Office, Mr N.V.N. Chari, Senior Administrative Officer, and Ms V. Aruna, Senior Administrative Assistant, for their kindness and care which they extended in abundance to ensure the smooth running of the review process.

The Panel members wish to record their appreciation to the iSC Secretariat for the efficient logistical and administrative support. The Panel is grateful to Ms Rosanna Corrazzi and Ms Tanya Alexander for compiling and formatting the Report and to Ms Irmi Braun Castaldi for providing assistance with the travel itineraries and air tickets.

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APPENDIX II

INTERIM TERMS OF REFERENCE AND GUIDELINES

FOR THE

FIFTH EXTERNAL PROGRAMME REVIEW OF ICRISAT

TERMS OF REFERENCE FOR EXTERNAL PROGRAMME REVIEW OF ICRISAT[6]

BACKGROUND

Context

1. The Consultative Group on International Agricultural Research (CGIAR) is an informal association of over 50 members that supports a network of 16 international research Centres in agriculture, forestry and fisheries. The CGIAR aims, through its support to the Centres, to contribute to promoting sustainable agriculture for food security in developing countries. Because the Centres constitute the core of the CGIAR, the effectiveness of each Centre is crucial to the continued success of the CGIAR as a System.

2. Each Centre is an autonomous institution operating within the mandate assigned to it by the CGIAR, and is governed by a legally constituted Board that has full fiduciary responsibility for managing the Centre. To ensure accountability in an essentially decentralized system, each Centre is expected to be responsive to the CGIAR, which provides financial support for its work.

3. The CGIAR has established a tradition of external reviews to provide a mechanism of transparency and accountability to the Members and other stakeholders of the CGIAR System. External reviews are conducted for each Centre approximately every five years. As each Centre is autonomous, external reviews provide a measure of central oversight and serve as an essential component of the CGIAR's accountability system.

4. Besides the External Reviews, Centre Commissioned External Reviews (CCERs) are undertaken at each Centre. These CCERs are commissioned by the Centre Boards to periodically assess the quality and effectiveness of particular aspects of a Centre's work. The terms of reference (ToRs) for each CCER are determined by the Centre.

5. External Reviews complement the CCERs by providing a CGIAR-commissioned and comprehensive external assessment of the Centre's programme and management, especially its future directions and the relevance and quality of its research. The ToRs for the external programme review (EPR) of ICRISAT are provided below. Guidelines for undertaking the review are issued separately.

[6] These interim ToRs for the Eternal Programme Rievew (EPR) of ICRISAT are derived from the standard ToRs for External Programme and Management Reviews (EPMR) of CGIAR Centres.

TERMS OF REFERENCE

Objectives and Scope

6. The EPR seeks to inform CGIAR members that their investment is sound, or recommend measures to make it so. Members of the CGIAR and other stakeholders can be informed whether the Centre is doing its work effectively and efficiently. The EPR is both retrospective and prospective; and help ensure the Centres' excellence, relevance and continued viability, and the coherence of the CGIAR System's research agenda. The review is expected to be strategic in orientation and programmatically as comprehensive as the situation warrants.

7. The broad objectives of the EPR is to: a) provide CGIAR members with an independent and rigorous assessment of the relevance and quality of research and research-related activities and the contribution of the Centre they are supporting to its goals and those of the CGIAR; and b) to provide the Centre and its collaborators with assessment information that complements or validates their own evaluation efforts, including the CCERs.

8. The EPR Panel is specifically charged to assess the following:

a) The Centre 's mission, strategy and priorities in the context of the CGIAR's vision, priorities and strategies;

b) The quality and relevance of the science undertaken, including the effectiveness and potential impact of the Centre's completed and ongoing research;

c) The effectiveness and efficiency of programme management, including the mechanisms and processes for ensuring quality; and

d) The accomplishments and impact of the Centre's research and related activities.

9. The topics expected to be covered by the EPR are listed below.

TOPICS TO BE COVERED

A. Mission, Priorities and Strategies

- The continuing appropriateness of the Centre's mission and goals in light of important changes in the Centre and its external environment since the previous external review.
- The policies, priorities and strategies of the Centre, their coherence with the CGIAR's goals (of poverty alleviation, natural resources management, and sustainable food security), and relevance to beneficiaries, especially rural women.
- The appropriateness of the roles of relevant partners in the formulation and implementation of the Centre's strategy and priorities, considering alternative sources of supply and the benefits of partnerships with others.

B. Relevance and Quality of Science

- The relevance and quality of the science practiced at the Centre.
- The effectiveness of the Centre's processes for planning, priority setting, quality management (e.g., CCERs, peer reviews and other relevance and quality assurance mechanisms), and impact assessment.

C. Effectiveness and Efficiency of Research Leadership and Programme Management

- The performance of the Centre's Board in programme oversight, the effectiveness of leadership throughout the Centre, and the suitability of the organization's research culture to its mission.
- The adequacy of the Centre's organizational structure and the mechanisms in place to manage, coordinate and ensure the excellence of the research programmes and related activities.
- The adequacy of resources (financial, human, physical and information) available for planning and implementing Centre's research programmes and the effectiveness and efficiency of their management.
- The effectiveness of the Centre's relationships with relevant research partners and other stakeholders of the CGIAR System.

D. Accomplishments and Impact

- Recent achievements of the Centre in research and research-related areas.
- The effectiveness of the Centre's programmes in terms of their impact and contribution to the achievement of the mission and goals of the Centre and the CGIAR.

GUIDELINES FOR THE EXTERNAL PROGRAMME REVIEWS OF ICRISAT[7]

INTRODUCTION

1. External Programme Review (EPR) of ICRISAT will be carried out in accordance with the process Guidelines outlined below and the Terms of Reference (ToRs) issued separately. The review is expected to be strategic in orientation and programmatically as comprehensive as the situation warrants. To be credible and acceptable, the review must strive to be objective, transparent and participatory. The reports must be direct, explicit and frank. These principles are observed throughout the review process.

2. Being a member of a review Panel is usually an interesting and rewarding experience. Moreover, Centre management and staff generally welcome the opportunity to discuss with Panel members their achievements, concerns and future plans. A healthy atmosphere of mutual respect and collaboration in the interchange of ideas is the key to the success of the review. It helps to ensure that the recommendations of the Panel are realistic, are well understood by the Centre management and staff, and will be willingly, or even enthusiastically, implemented.

GUIDELINES

3. The EPR is expected to maintain high standards of quality and rigor, and be conducted by an independent and objective Panel. The EPR is expected to assess the Centre in terms of its: mission and overall strategy, programme priorities and strategies; relevance and quality of its science; achievements and impact; and effectiveness and efficiency of programme management, as noted in the ToRs.

4. It is inevitable that the conduct of a review requires the collaboration of numerous individuals; as well as a process that enables the various participants to collaborate effectively in a complex assessment that has to meet high expectations and tight deadlines. The main participants in the EPR are: the EPR Panel Chair and members; the CGIAR Members; the interim Science Council (iSC) and its Secretariat; members of the Centre's Board, management and staff; the Panel's support team of external consultants and resource persons from the iSC Secretariat; and the Centre's many partners at the local, national, regional and international levels.

Roles and Responsibilities

5. **The CGIAR, iSC and the iSC Secretariat.** The CGIAR establishes external review policies for the System, and EPR is conducted on its behalf, in accordance with the ToRs and Guidelines. For each review, CGIAR Members are requested to propose Centre-specific issues for the Panel to consider, and receive the review report. Once the timing of the EPR has been determined, generally according to the 5-yearly schedule, the iSC and its Secretariat are responsible for the coordination and management of the EPR, and they provide guidance on matters of review design and Panel composition, in consultation with the Centre's Board and management.

[7] These interim Guidelines for the External Programme Rievew (EPR) of ICRISAT are derived from the standard Guidelines for External Programme and Management Reviews (EPMR) of CGIAR Centres.

6. A senior staff member of the iSC Secretariat will serve as a resource person throughout the review process, accompanying the Panel Chair and members during their visits to the Centre and on field visits. The iSC Secretariat resource person also serves as the Panel Secretary. Besides substantive briefings on technical, programme and programme management matters, the resource person assists the Panel on process matters, including the logistical aspects of report preparation and production. However, to help safeguard the EPR Panel's independence and objectivity, the Secretariat resource person is not normally expected to undertake substantive review, analysis or writing responsibilities on behalf of the Panel.

7. **The Panel Chair, Members and Consultants.** The leadership and task management skills of the Panel Chair are obviously critical, as are the expertise and experience of Panel members. The Panel Chair is appointed by the iSC in consultation with the Centre. The Chair's involvement begins early on, when he/she is consulted regarding Panel composition, and briefed by the iSC Chair and the iSC Secretariat about the review process and key issues and concerns regarding the Centre. Once the review is underway, the Chair is responsible for ensuring that the Panel undertakes its assessment and completes the task in accordance with the ToRs and Guidelines for this EPR. Given the magnitude of the task, the complexity of the issues, the fact that many Panel members may by unfamiliar with the CGIAR, the importance of maintaining dialogue with the Centre, and the need to produce a report that reflects the consensus of the Panel, the Chair's task is a demanding one.

8. Because the report should reflect the judgement of the whole Panel, all members of the Panel are expected to contribute to all aspects of the review report. The staff member provided by the iSC Secretariat assists the Panel Chair and members throughout the process, as appropriate. Consultants are also provided to the Panel, as needed, for limited periods of time, for assessment of specialized areas. While these consultants and resource person from the iSC Secretariat (and sometimes an iSC member) support the Panel's efforts as members of a team, ultimately the Panel is responsible for formulating the assessment and recommendations of the EPR report.

9. **The Centre Board, Management and Staff.** The Centre's Board, management and staff play a crucial role in the conduct of the review. They are heavily involved in planning the review, and subsequently in organizing the review and preparing for the Panel's visits to the Centre and to the field. Once the review is underway, it entails a significant degree of interaction between the EPR Panel and Centre staff, as part of a valuable two-way learning experience. Throughout the process, the collaboration and inputs of Centre management and staff are essential for the review to run smoothly and for the report to be credible and acceptable.

10. **The Centre's Partners.** Representatives of national agricultural research systems (NARS), regional fora, bilateral and multilateral agencies, NGOs and the private sector are important partners of CGIAR Centres, and their input is considered essential for the viability of the EPR review process. As part of the review, representatives of such organizations are consulted for their views on the Centre's long-term strategy, programme priorities and strategies and collaboration. This may be through Panel visits and/or meetings, as well as through questionnaires or interviews. The Panel may also visit or contact managers and researchers from other CGIAR Centres and other relevant institutions with which the Centre collaborates. Such consultations are valuable as a means of assessing the Centre's role in the CGIAR and in the global context. Given the vast number of collaborators or potential partners

of a Centre, such meetings must be limited. Their outcome is considered important, however, and is expected to feed into the Panel's assessment of the Centre.

Panel Composition and Report

11. **Panel Composition.** The review Panel is composed of experts in research and research management areas relevant to the Centre being reviewed who can carry out a comprehensive assessment and give the CGIAR their best judgement about the past performance and future potential of the Centre. The Panel is expected to make an independent assessment based on its own observations and other information available to it, particularly the evidence provided through CCERs (see below).

12. The EPR Panel normally consists of about five members, including the Chair. Panel members are generally selected for their ability to focus on the institution-wide issues relating to the Centre's mission, long-term strategy, research priorities and strategies and programme management and oversight. To ensure adequate coverage of the ToRs, the Panel composition usually meets the following requirements: a) the Chair and at least two Panel members are familiar with the CGIAR; b) at least two Panel members have a technical background relevant to the Centre being reviewed; and c) at least two Panel members have expertise in research organization, management and oversight.

13. **Panel Report.** The EPR report is expected to present an accurate account of the outputs and what is known about the impact of the Centre during the review period. It is expected that in-depth reviews of particular programme or programme management or programme oversight would have been undertaken earlier through CCERs - and would not normally need to be undertaken by the EPR Panel. This enables the EPR Panel to concentrate on the important strategic issues rather than on specialized detailed assessments of each programme, project or activity.

14. Because research in the CGIAR System is a long-term undertaking, the problems the Centre is working on may not have visible outputs until several years. For this reason, the review report is expected to provide convincing evidence on the relevance and quality of the completed and ongoing research, and the efficiency with which the work is conducted, as a surrogate measure of the potential impact of the Centre's current programme of work.

15. Although the EPR report is expected to be comprehensive, the Panel has considerable leeway in deciding on what issues it would focus in depth. The review report highlights the most significant issues faced by the Centre and makes recommendations on how the Centre (or the CGIAR) could address them. It provides assurances and convincing evidence to indicate that other aspects of the Centre's programmes and management (i.e., those not covered by the Panel's report in depth) are effective and efficient. It also comments on the effectiveness of the Centre's internal review system on which the EPR was based, and on how well the Centre has addressed the recommendations of the other reviews commissioned by the Centre.

Integration with Centre Reviews

16. It is expected that some detailed high-quality CCERs would have been completed within 2 or 3 years preceding the main phase of the EPR. The CCERs are undertaken by specialized external consultants, assisted by members of the Centre Board and staff as

resource persons (not participants). They are expected to cover at least portions of the Centre's main research programmes (including their relevance, direction, science quality, achievements, and, to the extent possible, impact) as well as aspects of Centre management (including programme governance, research organization and management, financial and human resource allocation for research and its management effectiveness).

17. The Boards would decide which programme related CCER reports are made available, at the time of their completion, to the iSC and its Secretariat. These reports, along with comments from the iSC and Secretariat staff, are made available to the EPR Panel, along with reports of the follow-up actions planned or taken by the Centre's management and Board. Other analytical papers - particularly internal assessments of programme performance and impact - and other background documentation prepared by the Centre are also provided to the Panel, at the discretion of the Centre. The Centre is responsible for providing this information in an easily accessible and usable form, so that the EPR Panel's conclusions can be based on a comprehensive and thorough review of all aspects of the Centre.

18. The CCERs - which are often very detailed and comprehensive - provide essential evaluative information to the EPR Panel on particular aspects of the Centre’s programme and management. Their availability in advance of the main phase of the EPR helps create an integrated system of Centre- and CGIAR-commissioned reviews of each Centre, and enables the EPR to be forward-looking and to focus more on strategic, rather than operational, issues.

19. The EPR, then, can serve as a vehicle for analyzing, verifying, and synthesizing the information already available through CCERs and other reviews, and for making this information available to a wider audience outside the Centre. While the Centre's Board and management are responsible for ensuring that the internal evaluation system is sound (in terms of scope, coverage, quality and timeliness), judgements on the adequacy of a Centre's quality assurance system, including the processes for undertaking CCERs and other mechanisms of peer review, are the responsibility of the EPR Panel.

Review Design and Board Assessment Visit

20. Interactions between the Centre Board and the Panel form an essential component of every review, given the Board’s important role in the CGIAR System. Hence, early in the process, prior to (or sometimes during) the first visit of the full Panel to the Centre (see below), the Panel Chair along with iSC Secretariat resource person and possibly one other Panel member or consultant attend a Board meeting, and interview Trustees concerning Board and Centre matters related to the overall research and programme strategy, programme oversight and management, research and research-related priorities and strategies. This design visit helps ensure the participation of the Board in the planning and design of the upcoming review, including the identification of key issues and concerns of relevance to the EPR.

21. The design visit also provides the Panel Chair and selected members or consultant an opportunity to review any documentation provided to the Board, interact informally with individual Board members, observe at least one formal meeting of the Board and its committees, and serve as an element in assessing the Board’s effectiveness and operations in so far as these apply in assessing the relevance and quality of programmes and the future evolution of the Centre. The preliminary assessment of the Board is made available to the Panel (but not the Centre), and is modified as appropriate during the main phase of the EPR (see below).

22. In assessing Board effectiveness and operations, the Panel takes into account the key legal documents governing the Centre - particularly the Establishment Agreement, the Headquarters Agreement, and the Constitution of the Centre. It also keeps in mind the main provisions of the *Guidelines for CGIAR Boards*, particularly the guideline on the "Role, Responsibilities and Accountability of Centre Boards of Trustees", as they apply to programme oversight, leadership and management.

Panel Appointment and Briefing Phase

23. Following the Panel Chair's visit for discussions with Board members (or sometimes coinciding with it) and the issues identified, the full Panel will be appointed. Once appointed, the Panel will receive briefings from iSC Secretariat staff and Centre management on the recent developments in the CGIAR and the Centre being reviewed, and on the processes, quality and content of the CCERs made available to the Panel. The Panel will be briefed by the Panel Chair and Secretary in a virtual mode. Subsequently, the Panel will receive a virtual overview briefing on the Centre's current activities and future plans, and further elaboration of the strategic issues to be covered by the review team. The Panel will prepare preliminary drafts of key sections based on an agreed outline of the report which will be completed during the main phase several months later.

24. Briefings in a virtual mode by the iSC Secretariat resource person cover technical and programme management/oversight matters such as the CGIAR's mission, priorities, strategies, programmes and impact assessments as well as management matters including Board's programme governance. These briefings by the iSC Secretariat also cover the CGIAR's expectations regarding the scope and process of the review (as outlined in the TORs and Guidelines for EPR); as well as an overview of programme and programme management issues of relevance to the Centre being reviewed. The resource person from the iSC Secretariat also provide substantive and process-oriented support as requested by the Panel Chair.

25. The Panel then receives briefings, e.g., through documents and PowerPoint presentations shared with the Panel; a structured e-mail conference among Centre senior staff and Panel members; and tele- or videoconferencing, from Centre management and senior staff on the Centre's long-term strategy, research priorities and strategies, programmes, programme (research and research-related) management and research leadership. These briefings focus particularly on the Centre's recent developments and achievements, CCER findings and conclusions, and future plans. In addition, the Panel seeks additional information from other Centre staff, on a selective basis, as needed; and invites Centre staff members during main phase, either individually or in small groups, to voluntarily share their concerns, if any, regarding Centre-wide programme and research management issues.

26. To help ensure that these briefings and discussions are as comprehensive and up-to-date as possible, and to enable the Panel to obtain a comprehensive overview of the Centre's work, the Centre is expected to provide to the iSC Secretariat and Panel members, in advance, copies of the recent CCERs and other assessments undertaken, as well as other relevant Centre-related documentation (such as the latest Strategy document, Medium Term Plan, and other relevant policy documents or analytical papers prepared by the Centre). For the list of documents generally provided to the Panel by the iSC Secretariat and the Centre, see Attachment I. The Centre should prepare documents specifically for the review, and these

should include those indicators of scientific quality as agreed by iSC, Panel Chair and Secretary: e.g., publications, breakthroughs, solutions to problems, new technologies and other products, awards and other recognition of scientists).

27. Once the briefings are completed, the Panel spends few days to prepare preliminary drafts and précis of sections based on the outline of the report agreed by the Panel and the writing responsibilities assigned by the Panel Chair. This ensures that the Panel undertakes a significant amount of preliminary drafting prior to the main phase of the review, and continue its assessment of the key issues and concerns during the period between the briefing phase and the main phase.

Field Visits

28. To help ensure that the EPR Panel's assessments are adequately grounded in the reality of the Centre's circumstances, the Panel members are expected to undertake country field visits, jointly determined by the Centre, Panel Chair and the iSC Secretariat. The field visits cover the major non-headquarters based operations of the Centre, so as to provide a realistic assessment of the Centre's field operations, working conditions, and interactions with NARS and others in the region. These visits by Panel members (as smaller "sub-panels", if necessary) are often few days each, and are undertaken before the main phase of the review.

29. A senior staff member from the Centre normally accompanies the (sub) Panel members on these field/country visits, but does not participate in substantive discussions with country officials or representatives of regional fora. The resource person from the iSC Secretariat helps coordinate the field visits and accompany the Panel members, as requested by the Panel Chair. These visits supplement any surveys of NARS and Centre staff, organized by the resource person from the Secretariat in advance of the main phase.

Main Phase and Report Writing

30. The EPR Panel visits the Centre for a period of about ten days to undertake the main phase of the review, and to bring its report to a semi-final draft stage. As noted earlier, the Centre is expected to have made available to the Panel, well in advance of this visit (through the Panel Chair and Secretary), copies of CCER reports and other relevant documents; and the Panel is expected to have completed the field visits and been adequately briefed by the resource person from the iSC Secretariat. The Panel is thus expected to be reasonably well informed about the Centre and be familiar with other detailed evaluations of its specific programmes and activities by the time it undertakes its own assessment of the Centre.

31. The EPR Panel's report is expected to focus on the four topics covered in the ToRs - namely, the Centre's: a) mission, strategy and priorities; b) relevance and quality of science; c) effectiveness and efficiency of research leadership and programme management; and d) what is documented about accomplishments and impact. The report is expected to be succinct and written in plain language, focusing on strategic issues. It can, where relevant, propose forward-looking recommendations on overall direction and priorities (rather than on detailed programme content or operational management). The writing style is expected to be direct, explicit and frank.

32. Since descriptive material and detailed analysis is expected to be kept to a minimum, a report of about 50 pages - with suitable cross-referencing (not summaries) of the CCERs - is

expected. However, if the CCERs available to the Panel are inadequate in quality, coverage or depth, the EPR Panel's report is expected to compensate for gaps through its own analysis and assessment.

33. The drafting of the EPR report is completed soon after the main phase visit, and the final draft chapters are shared with the Centre management to ensure their accuracy and completeness. The Panel Chair formally transmits the document to the iSC Chair. If convenient, the main findings and recommendations of the final EPR report are normally expected to be presented by the Panel Chair to the Centre Board, management and staff.
Response and Follow-up.

34. The Board and management of the Centre under review are expected to submit a formal written response to the EPR report, addressed to the iSC. Then the iSC discusses the report in the presence of the Panel Chair and representatives from the Centre (including the Board Chair and Director General), and prepares a commentary, including recommendations for follow-up action by the CGIAR or the Centre. The EPR report, the Centre's written response, and the iSC commentary are then simultaneously distributed to and considered by ExCo and also posted on the Web where it is available to CGIAR member agencies and all interested stakeholders prior to the formal discussion by the Group at its annual meeting.

CONCLUSION

35. EPRs provide the CGIAR and other stakeholders very valuable information on the accomplishments and future prospects of each Centre funded by the Group. Because they undertake a comprehensive strategic assessment of all key aspects of the institution, such reports from an independent external Panel can provide much needed assurance to the CGIAR Members - as well as to the Centre's Board, management, staff and partners - about the Centre's direction and its institutional capacity to produce the desired research and research-related results. If significant changes in direction, scope, focus, or mode of work are required, these too can be made on a systematic and periodic basis, based on Board-endorsed EPR recommendations. In any case, the Centre and the System benefit from such reviews.

Attachment 1

LIST OF DOCUMENTS
FOR THE EXTERNAL PROGRAMME REVIEW OF ICRISAT

The following is a list of documents for the Panels conducting the External Programme Review of ICRISAT. Copies of relevant documents should be sent to Panel members in advance by ICRISAT and the iSC Secretariat as indicated. Copies of all documents should be available at ICRISAT during the review.

Documents	iSC Secretariat	Centre
To all Panel members:		
1. Terms of Reference and Guidelines for External Programme Review of ICRISAT. Provided with the appointment letter.	X	
2. Most recent External Programme and Management Review report of the Centre. 4th ICRISAT EPMR 1997.	X	
3. One recent External Programme and Management Review report. 5th IITA EPMR 2001.	X	
4. Most recent CGIAR stripe studies involving the Centre. Plant Breeding Methodologies ICRISAT sub-report 2000. SGRP External Review 1998. SP-IPM External Review 2002.	X	
5. Vision and Strategy for the CGIAR.	X	
6. Most recent TAC paper on CGIAR Priorities and Strategies.	X	
7. Relevant extracts from TAC/iSC commentaries of Medium Term Plans. From 1998-2000 to 2003-2005.	X	
8. Most recent Annual CGIAR Funding Requirements document.	X	
9. Most recent CGIAR Annual Report.	X	
10. Most recent CGIAR Brochure and Directory.	X	
11. Summary of Proceedings of CGIAR meeting(s) conducted over the recent years.	X	
12. Report of the review of the CGIAR Genetic Resources Policy Committee 2002.	X	
13. A brief paper outlining the major issues confronting the Centre. From the ICRISAT Board and management. Priority mailing.		X
14. A document summarizing the main achievements, constraints and impact of the Centre programmes since the last CGIAR external review. To also include outputs from 1997 by projects – ready at least a month before the design visit.		X
15. Summary of actions taken in response to the last External Programme and Management Review. Ready at least a month before the design visit.		X
16. A document describing the conceptual framework and implementation of relevance and quality of science at the Centre. Ready at least a month before the design visit. The document should be comprehensive, covering research planning, priority setting, research process, research outputs and outcomes, peer review mechanisms, performance assessment, etc.		X
17. The latest Board-approved Strategic Plan of the Centre. Priority mailing.		X
18. The Medium-Term Plans of the Centre since the last review. Priority mailing.		X
19. Most recent Annual Reports of the Centre, and comparable research reports of the programmes. Priority mailing.		X
20. The current organization chart, with a brief description of the Centre's internal management structure, including the composition and terms of reference of each major committee. Priority mailing.		X
21. List of senior staff with CVs including “measures of esteem”: publications, key committee/Board memberships, lectures, prizes/awards, patents, grants – to be adjusted for ICRISAT’s circumstances through suggestions from management and staff. To be available by the time of the design visit.		X

Documents	iSC Secretariat	Centre
22. Centre-Commissioned External Review Reports, including main report, ToRs, Centre response and follow-up statements, all in electronic form. Priority mailing.		X
23. List of reports of major planning conferences, internal reviews, expert meetings, etc., which have had a major influence on the direction of specific Centre programmes.		X
24. Self-studies, if conducted, assessing strengths and weaknesses of Centre programmes and/or management.		X
25. A list of staff publications during the period under review, per year, per category and project – ICRISAT should decide the appropriate categories (in addition to peer reviewed articles). To be available by the time of the design visit.		X
26. List of the agreements for cooperative activities with other centres and institutions.		X
27. List of ongoing and recently completed contracted projects.		X
Supplementary documents, provided to relevant Panel members:		
28. Most recent statements of CGIAR policies of relevance to the Centre.	X	
29. Most recent CGIAR financial guidelines and manuals.	X	
30. Reference Guides for CGIAR Centres and their Boards of Trustees.	X	
31. Committees and Units of the CGIAR: Roles, Responsibilities and Procedures.	X	
32. Charter and other basic documents establishing the Centre, along with subsequent amendments.		X
33. Table showing composition of the Board over the last five years, along with an indication of the term of office of current members and their roles on the Board.		X
34. Board handbook or rules of procedure.		X
35. Table showing allowances, benefits, and salary ranges for each category of staff.		X
36. Table showing personal data on internationally recruited staff by programme, including each job title, incumbent's location, period of tenure, gender, nationality, age, salary over the last three years, funding source (excluding names).		X
37. Table summarizing turnover of staff over the last five years by staff category.		X
38. List of international staff vacancies and how long positions have been vacant.		X
39. Brief description of the Centre's information management systems and procedures (e.g., library and documentation, archives and records management, computer and information technology, management information systems).		X
40. Set of minutes covering Board and Board committee meetings since the last External Review (and reports of Board committees to the full Board if not included in the minutes).		X
41. Staff manual or a description of current personnel procedures for international and locally-recruited staff.		X
42. Local compensation surveys used by the Centre.		X
43. Reports of external auditors, including management letters, and financial officer's reports to the Board since the last External Review.		X
44. Most recent internal audit reports.		X

APPENDIX III

ITINERARY OF THE EPR PANEL

The Panel Chair was briefed by the iSC Chair, Emil Javier, and the iSC Secretariat at FAO on 22 January 2003. The Panel Chair and the Panel members appointed by that time visited the ICRISAT HQ from 10-14 March 2003 for an initial design visit. The visit was planned to coincide with the Board meeting. Senior management and research staff made presentations on ICRISAT's vision, strategy and programmes. The Panel members attended the meetings of the Programme Committee and the Technology Exchange Committee of the Board where presentations were made on three of the six thematic programmes, information management and resource mobilization. The Panel had a special session with the Board to discuss issues and challenges facing ICRISAT. Enroute to ICRISAT, the Panel Chair visited Delhi to meet the DDG Education of ICAR who contributed to the World Bank meta evaluation of the CGIAR System in which ICRISAT was evaluated.

In May, the Panel Chair and one Panel members visited ICRISAT's regional team based at the ICRISAT Sahelian Centre, Niamey. Aside from site visits to Sadoré and off station, the Panel members were briefed extensively by the ISC and Mali staff. An overall presentation was followed by a presentation on the Medium Term Strategy for WCA and the Desert Margin Programme. Subsequently, the cereal and groundnut breeding programmes were discussed followed by the New Sahel initiative. Finally some economic thoughts on the shift from commodities to systems were shared with the Panel. These led to numerous discussions with staff members in the course of 3 days. Also visits were paid to the various stakeholders such as EU rep, INRA director and his staff, FAO rep, and two regional meteorological bodies; ACMAD and AGRYMET. In addition, a meeting with NGO's (Africare), farmer associations and private dealers in inputs, seed and produce was arranged in Niamey with a free and open exchange of views. The Panel Chair also visited the Director of INERA in Ouagadougou, Burkina Fasso and several of the senior staff members.

Also in May, one other Panel member and the iSC Secretariat resource person visited the ICRISAT teams in Southern Africa and Eastern Africa. The visit to Southern Africa included a meeting with the regional team members at Matopos, Bulawayo, who made presentations on the emerging regional strategy as well as on the work being done on sorghum, millet and groundnut crop improvement and seed systems, crop and natural resources management, marketing and commercialization, networking and resource mobilization. In Bulawayo, discussions were also held with the national collaborators: the Directors of AREX and Livestock Production, the Managing Director of the African Centre for Fertilizer Developments and a representative of CARE Zimbabwe with whom ICRISAT collaborates. In Harare, discussions were held with: Principal Director, Ministry of Lands, Agriculture and Rural Settlement; the Director, SADC Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN); the FAO Regional Representative for Southern and Eastern Africa and Regional Technical Officers in charge of the NRM work in the region and of the emergence operations in Zimbabwe; Pro Vice Chancellor of the University of Zimbabwe and collaborators in NRM; representatives from Seed Co. Zimbabwe and Zimbabwe Fertilizer Company. Discussions were also held with the CIMMYT Team Leader in Zimbabwe.

The visit to Eastern Africa included meeting with the regional team members at ICRAF, Nairobi, where they are housed, and visiting ICRISAT's field work in and near Kiboko some 90 km east of Nairobi. The field visit included visiting a participatory

pigeonpea improvement location near Kiboko. The ICRISAT regional team members made presentations on the overall strategy, crop improvement, priority setting process, public-private partnership in the context of seed systems, soil and water and biotechnology. Discussions were also held with collaborators: the Director of KARI; Kenya Agricultural Commodity Exchange; and Nestle Ltd.

The Panel undertook a main phase visit to the HQ from 16 to 26 June 2003. The Panel updated by the senior management on the evolution of ICRISAT's strategic framework and the evolving global strategy. The Panel also had an opportunity for further discussions and clarifications with staff. Also, a roundtable half-a-day meeting was held at CRIDA with senior representatives of a range of stakeholders including ICAR, national crops research programmes, research institutes, universities, private sector biotech and seed companies, extension agency and NGOs. On 26 June, the Panel Chair presented the main findings and recommendations initially to ICRISAT management group and then to the staff.

APPENDIX IV

DOCUMENTS PROVIDED TO THE EPR PANEL BY ICRISAT

1. Major issues confronting ICRISAT's Research Agenda for 2003 and beyond
2. Paper summarizing the main achievements, constraints, and impact of the Centre Programmes since the last CGIAR external review
3. Action taken by ICRISAT in Response to the recommendations of the Fourth EPMR
4. ICRISAT's response to Fourth EPMR Suggestions
5. Document describing the conceptual framework and implementation of relevance and quality of science
6. ICRISAT's Vision and Strategy
7. Medium-Term Plans of the Centre since last Review
8. Partnerships in Research for Development – ICRISAT Annual Report - 1998
9. Building Tomorrow Together – ICRISAT Annual Report – 1999
10. Science with a Human Face – ICRISAT Annual Report – 2000
11. Grey to Green Revolution – ICRISAT Annual Report – 2001
12. Research for Impact – ICRISAT Annual Report - 2002
13. Current organization chart and major committees
14. List of senior staff with summary of qualifications
15. Report of CCER on Information Resource Management and of Partnerships at ICRISAT, November 1999
16. Report of CCER on Natural Resource Management Programme, September 2000
17. Report of CCER on Socioeconomics and Policy Programme, January 2002
18. Report of CCER on the functions – Administration, Finance, Human Resources and Operations, August 2001
19. List of reports of major planning conferences, internal reviews, expert meetings, etc. which have had a major influence on the direction of specific Centre programmes
20. List of staff publications during the period under review
21. List of agreements for cooperative activities with other centres and institutions
22. List of ongoing and recently completed contracted projects
23. Table showing composition of the Board over the last five years, along with an indication of the term of office of current members and their roles on the Board
24. ICRISAT Governing Board Handbook - Charter and other basic documents establishing the Centre, along with subsequent amendments
25. Table showing Allowances, benefits, and salary ranges
26. Table showing Personal data on internationally recruited staff
27. Table showing Turnover of staff over the last five years
28. Note on list of international staff vacancies
29. Note on compensation surveys
30. Brief description of the Centre's information management systems and procedures
31. Set of minutes of Governing Board, Board Committee Meetings [Programme Committee (PC) and Joint Programme Committee and Technology Exchange Committee (Joint PC-TEC), Technology Exchange Committee (TEC) , Executive Committee (EC), Finance Committee (FC), Nominations Committee (NC)] since the last External Review
32. Staff manual/ description of current personnel procedures for international and locally-recruited staff
33. Reports of External Auditors, management letters and financial officer's reports
34. Most recent internal audit reports
35. Future Challenges and Opportunities for Agricultural R&D in the Semi-Arid Tropic

36. What is ICRISAT doing in Asia and Africa and Why?
37. Historical Evolution of ICRISAT strategy
38. International Public Goods derived from research at ICRISAT
39. Assessment of Science Quality at ICRISAT
40. ICRISAT-NARS relations 1996-2003
41. Overview of Unrestricted Funds Allocation 1996-2003
42. ICRISAT Research Areas Dropped/De-emphasized since 1997 and New Areas Initiated since the New Vision and Strategy
43. Requirement of Scientists – current level, optimum level, projections
44. CGIAR Effectiveness – NARS perspective by Dr J C Katyal, and Dr Mruthyunjaya
45. Measures of Esteem, Awards – Scientific staff and Support staff
46. Scientific staff and Support staff – details including staff time in each global theme, qualifications, experiences etc.
47. Information Resource Management at ICRISAT: Status of implementation

APPENDIX V

Fourth EPMR Recommendations, ICRISAT'S Response and Action Taken and Fifth EPR Panel Observations

Panel Recommendations	ICRISAT's Response
1. The Panel endorses the pursuit of research on methodologies, such as participatory breeding, that could provide new and powerful tools and approaches toward germplasm evaluation and enhancement, and because of the potential power of molecular biology to address some of the more pressing limitations to crop production in the SAT, the Panel recommends that the present commodity improvement programmes of ICRISAT at Patancheru should evolve into a global germplasm strategic research effort with germplasm evaluation and enhancement components that would provide intermediate products to commodity improvement programmes operated by ICRISAT in Africa and NARS in all continents in a partnership mode.	**Response:** ICRISAT accepts the recommendation, and view it as an acceleration of an ongoing process. However, sufficient linkages to applied work must be maintained to enable the effective transfer of these strategic outputs to partner institutions. **Action taken:** Much progress has been made in strengthening global synergies between ICRISAT's genetic enhancement work in Asia and Africa and in unifying them into a cohesive global programme. • The cutting-edge Applied Genomics Lab (AGL) created since the Fourth EPMR works on high-priority traits identified by breeders on both continents [for example, resistance to groundnut rosette virus, resistance to *Helicoverpa* spp. and sorghum stem borer]. These genes as well as others discovered in screening the gene bank collection in Asia, are bred into parental lines (intermediate products) at Patancheru, which are then sent in early generation stages to Africa for further testing, crossing and selection for regional adaptation. This is a highly effective and cost-efficient global R&D model taking advantage of the low costs and high technical capabilities available in India and at ICRISAT's long-established Headquarters in Patancheru. • Continuous feedback from staff based in Africa is highly influential in guiding the priorities of genetic enhancement work in Asia. Presently, there is at least one breeder for each mandate crop in Asia; and two each in Africa for sorghum, millet, and groundnut (agronomy, physiology and selection work are also carried out on chickpea and pigeonpea in Africa, although these crops are less important on that continent). These Africa-based staff participate vigorously in the annual Workplan Meetings and play a major role in designing the global annual work programme, and remain in close contact with their Asia-based colleagues year-round. • African researchers also influence the Asian agenda in other ways. A prime example of this Asia-Africa synergy in action is the continuing initiative to stay several steps ahead of the devastating downy mildew disease of millet. African germplasm contributed resistance that saved the Asian crop (and won ICRISAT its first King Baudouin Award in 1996). Based on field observations from scientists based in Africa, scientists in Asia have continued to monitor the disease race pattern in Africa using host-pathogen race differentials, molecular markers and genetic analysis. Since the recent creation of the AGL, they have been able to add powerful molecular marker approaches to accelerate the pyramiding of resistance genes appropriate to resist African pathogen configurations. • Participatory methods have become a major feature of ICRISAT's plant breeding work. ICRISAT was a CGIAR pioneer in this area with the participatory breeding of Okashana-1 millet in Namibia in the 1980s and in-depth studies of farmer varietal choices for millet in Rajasthan, India in the 1990s. This approach has been extended to sorghum in Mali since the Fourth EPMR. The approach is also being taken with leguminous crops. The recently released, highly successful chickpea variety 'Swetha' in Andhra Pradesh (King Baudouin Award 2002) was identified and popularized by farmers. The

Panel Recommendations	ICRISAT's Response
	groundnut cultivar CG-7 in Malawi was extensively tested by farmers before release and seed dissemination is being realized through a farmer-to-farmer plan. To better understand how farmers share seed and change varieties, as an alternative to top-down and often ineffective state seed distribution, in-depth research is underway from ICRISAT-Nairobi on farmer's seed systems and markets. • ICARDA and ICRISAT (as co-proposers of the DDPA Challenge Programme), with leading-edge input from the renowned nonprofit biotech organization TIGR, jointly proposed a novel approach called "Participatory Biotech" to perform molecular marker analysis on lines identified by farmers such as stress-resistant, including their traditional as well as improved varieties. Through this 'stress microarray' approach, superior field resistance will be associated with markers that can then be used to pyramid valuable genes more efficiently, through iterative stages of farmer field-testing and breeder crossing/pyramiding. **Panel's comments:** The Centre accepted the recommendation and implemented it as promised. The Panel commends ICRISAT for building an exemplary global germplasm strategic research unit. The Centre is now in a position to strengthen this effort through a set of strategic alliances. The Panel notes the actions taken by ICRISAT to put up physical facilities for biotechnology and including all stakeholders in setting the research agenda and priorities of the germplasm enhancement programme. However, the Panel believes that ICRISAT fell short in its efforts to achieve the full operational integration of the plant breeding and biotechnology activities in all mandate crops. Due to various problems ICRISAT does not have sufficiently strong plant breeding programmes for its mandate crops in Africa at this time .
2. In view of ICRISAT's large international genebank holdings of its mandate crops, its world class research facilities at Patancheru and the need for greater emphasis on strategic research in germplasm of SAT crops, the Panel **recommends** that ICRISAT adopt a new paradigm in strategic germplasm research using all necessary disciplines and 'new science' to exploit, more scientifically, systematically and fully, the genetic endowment represented in the genebank.	**Response:** This recommendation is accepted. Since ICRISAT's germplasm collection has no equal, its fuller exploitation using cutting-edge science will position the Institute in a leadership role, and should attract strong global collaboration and donor support. **Action taken:** The period since the Fourth EPMR has seen great progress in the acquisition of new-science skills and facilities in the areas of molecular genetics, immunology, bioinformatics and GIS, and in their application towards germplasm enhancement in an integrated paradigm with multidisciplinary field research. • Examples include: molecular diversity assessment to improve gene bank characterization and underpin breeding efforts to increase diversity, including the creation of regional core subsets; developing molecular tools and methodologies to enable "allelic mining" of the genebank, for speedier and more cost-efficient discovery of valuable new genes; the application of GIS to relate adaptive characteristics of genebank accessions to climatic and latitudinal zones; the improvement of monoclonal antibody techniques for more precise pathogenic race determination and resistance screening; major advances in genetic transformation methods and their application; and many others. • To place this initiative on a firm foundation, it was essential to immediately strengthen the operations, procedures and facilities of ICRISAT's genebanks. Major investments were approved for this purpose despite severe funding pressure on

Panel Recommendations	ICRISAT's Response
	the Institute. International standards for the safe maintenance of the collection were implemented, including the transfer of thousands of accessions into long-term storage for greater safety. Safety duplication agreements were implemented for all mandate crops. Baseline viability testing was carried out to safeguard the quality of the most active collections. Genebank scientists have published the results of this work in numerous international refereed journal articles. • To ensure the completeness of collections and their accessibility and utilization by national programmes especially in Africa (an approach endorsed by the CGIAR Systemwide Review of Plant Breeding Methodologies), regional gene banks and working collections were established in Southern and Eastern Africa under the auspices of regional organizations. **Panel's comments:** The Centre accepted this recommendation and anticipated strong global collaboration and donor support. The Panel recognizes the accomplishments of the Centre but notes that it has not (yet) had the desired effect on donor support. The Panel feels that ICRISAT has made substantial progress in this area. The Panel is of the view that the actions taken to date are just the beginning of the strategic germplasm research of SAT crops and urges ICRISAT to continue to make significant contributions to generate IPGs in this area of research.
3. Because the Panel strongly supports the use of watersheds by ICRISAT as a basis for understanding production constraints, and notes the existence of seven on-station watershed experiments which occupy an area of 80 ha at Patancheru; and because the long-term data accumulating from these experiments are very valuable and already have been used in development and validation of biophysical production models; and considering that very few such watershed research facilities exist in the developing world and that their presence at Patancheru is unique in the SAT, the Panel **recommends** that ICRISAT give high priority to the maintenance of watershed facilities and studies at Patancheru, and in particular to the maintenance and analysis of the data which have	**Response:** We agree that these studies are important, but need to examine them in the context of the overall research agenda. In view of declining resources and the EPMR recommendation to refocus resource management research on Africa, those aspects of the Patancheru watershed studies, which have global implications and transferability, will be viewed as the most important. The analysis and documentation of accumulated results will also be a high priority. **Actions taken:** • In view of declining resources, watersheds BW1 and BW2 have been taken out of active research yet maintained as demonstration plots for popularizing best practices identified from over two decades of research. They can be readily re-activated for research if and when funds allow. Other watersheds are used for crop improvement and management research as needed. • Considerable progress has been achieved in analyzing the accumulated data of watershed experiments. Important findings have been published on rotations and intercropping, water balance, nitrogen flows, carbon fixation, and other areas (See Appendix 1). • In response to a recommendation of the NRMP CCER, ICRISAT is rapidly mainstreaming simulation modeling as a systemic approach to integrated natural resource management. This enhances cost-efficiency and alleviates somewhat the constraint in funding for on-station field research at Patancheru. • There has been a strong shift off-station towards participatory, community-based watershed pilot projects in Asia through targeted donor support. These projects are highly successful and are attracting increasing attention and support. With the transfer of a soil/water management expert from India to Nairobi, efforts are underway to extend community-based watershed activities to East Africa, including to new sites in Ethiopia. • On the recommendation of the NRMP CCER, consideration is being given to holding a workshop on future exploitation of

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accumulated over time from these experiments.	the watersheds, perhaps bringing together experts involved in these and similar watershed work in India, and elsewhere. Since the last NRMP CCER ICRISAT have undertaken a number of activities to look at potential south-south linkages in watershed development. Since 2002, GT3 Asia have been carrying out a number of synthesis studies, including meetings, to document the process behind watershed development, to identify the enabling conditions, to articulate the lessons learned to date, and to project the way forward. • Based largely on its recognized watershed and soil management expertise, ICRISAT was asked by the East African (ASARECA) region to coordinate the European Union-funded 'Soil Water Management Network for Eastern Africa' (SWMNet). This network joins the collective experiences of 9 East African countries in a coordinated approach. Close linkages are maintained between the Asian and African teams with sharing of knowledge, methodologies and approaches. **Panel's comments:** The Centre agreed to the principle of the recommendation, but with a significant caveat that, under financial constraints, the IPG component of the watersheds would be given priority. The Centre has turned some watersheds into demonstration units but maintains some for research. Watershed work has moved off campus, but largely remained in Asia. Data analysis is progressing. The Panel considers some of the work off-site or outside the mandate zone to be activities in which ICRISAT does not have a comparative advantage and regrets the slow progress in transferring this work to Africa.
4. In the light of: (a) the need to rationalize the balance and emphasis of natural resources management (NRM) research activities between Africa and Asia; (b) the complexity of NRM research, (c) the history and present state of NRM research of ICRISAT; (d) the need to adopt an Integrated NRM (INRM) research framework in Africa; (e) the need to give priority to strategic germplasm research at Patancheru while reducing commodity improvement and NRM work in India; and (f) the Panel's proposal to focus the bulk of the INRM work in Africa, the Panel **recommends** that the Institute should undertake a collaborative strategic planning exercise in INRM to formulate research priorities and	**Response:** ICRISAT agrees with the need, but feel that it is already being addressed through a number of past and current reviews. These involved extensive interactions with NARS, for example in the formative stages of the Desert Margins Programme, as well as in other cases. These will continue, in parallel with the execution of agreed aspects of the joint agenda. **Actions taken:** ICRISAT has engaged in a continuing series of reviews and consultations since the Fourth EPMR to increase the effectiveness and relevance of its INRM work and foster the shift of emphasis to Africa, while advancing its work on focused topics in Asia as well (see Rec. 3). • Building on earlier CCERs on Soil and Water Management, NRM Research in West Africa, and NRM Research in Southern Africa, a comprehensive CCER on the Natural Resources Management Programme was carried out in 2001. The NRM CCER Panel confirmed that a major shift in effort to Africa had taken place. The Panel was impressed with the close-knit collaborative arrangements with the NARS in Africa. • In 1999, ICRISAT engaged in an Institute-wide development of its 'Africa Agenda', a forward-looking strategy that involved NRM as well as commodity aspects. The Africa Agenda identified poor soil fertility as the most widespread limitation to improving agricultural productivity on the continent. It positioned the Centre's programmes and approaches for addressing this and related NRM constraints to achieving greater impact on the continent. • ICRISAT actively participated in, and contributed to, CGIAR-wide thinking through participation at the Penang, Cali and Aleppo INRM workshops, as well as through OSWU. ICRISAT has adopted the INRM framework for its own research. A consistent point championed by ICRISAT and accepted by the group is that INRM must look beyond its ecological origins

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operational strategies, particularly in fostering effective partnerships with NARS.	to also include agricultural input supply-channel and output market dimensions. This view emerged from our leading capacity and innovative research in these areas carried out at ICRISAT's Bulawayo and Nairobi locations, and more recently at ICRISAT-Niamey. • Across both Africa and within its focus areas in Asia, ICRISAT has continued to participate closely with NARS, regional organizations (ROs -- (FARA and APAARI)) and subregional organizations (SROs -- SADC, CORAF-WECARD, and ASARECA) and their affiliated regional networks and institutions in their and our strategy and planning meetings. From these events ICRISAT staff keep well informed about regional priorities, and actively contribute their own insights and advice to these deliberations. • NARS have strong confidence in ICRISAT's partnership commitment in NRM. ICRISAT was invited to coordinate a new network in the ASARECA zone (East Africa) on Soil and Water Management (SWMNet). ICRISAT'S Bulawayo partner activities was nominated by SADC and chosen by FARA as 'Best Partnership' in 2001. In a unique example of active partnership, ICRISAT jointly established and staffed a GIS lab for the West Africa region, with the national programme of Mali in Bamako. • As a major strategic evolution, ICRISAT has substantially strengthened its innovation in participatory approaches to NRM, developed and implemented in close partnership with NARS. In Southern Africa, the Institute built a reputation for participatory soil-water-nutrient management research, involving farmers in identifying and selecting among a suite of different options most relevant to their own situations. It has also initiated strong research on farmer-to-farmer technology dissemination; on farmer and village-scale agro-enterprise development; and on the utilization of farmer knowledge for cropping systems diversification. In Western Africa, the Desert Margins Programme has been highly consultative and participatory in its approach, depending heavily on national initiatives implemented by supporting NARS (both financially and through capacity-building) to carry out participatory consultations with farmers and communities to set priorities. In Asia, the watershed initiative has fundamentally redirected its approach towards participatory community-based development. **Panel's comments:** ICRISAT did not accept this recommendation as it felt the strategic plan was in place. Yet, it continued reviews and consultations. ICRISAT feels that, through its actions it has shown that it has shifted its emphasis to Africa while re-focusing its INRM work in Asia. This was done in a process of extensive consultation. The Panel agrees that some initiatives were taken to implement this recommendation, but sees the implementation as inconsistent and incomplete.
5. Given the proposed shift to greater emphasis on strategic research within ICRISAT, thereby allowing the Centre to become a 'magnet centre' for research on major global problems (e.g., strategic research in germplasm	**Response:** ICRISAT concurs with the recommendation made. It recognizes that policy guidelines must be developed which reflect our priorities and those of our partners, including the relevant resource implications. **Actions taken:** ICRISAT has been deepening its closest and strongest partnerships – those with the NARS and their regional and subregional bodies – while also broadening them to include NGOs and the private sector, environmental groups, marketing and input supply organizations, philanthropic organizations, international initiatives, and advanced research institutions. It has

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and natural resources management); the complementary talents in NARS and ARIs of both developing and developed countries with those in ICRISAT; and the need to develop partnerships to exploit the strategic/applied/adaptive research continuum, the Panel **recommends** that ICRISAT should broaden its partnerships and deepen the strength of its efforts along the strategic applied/adaptive research continuum by continuing to develop even further its proactive visiting scientist programme, and placing greater emphasis on professional development for NARS, ARIs and ICRISAT staff.	also developed and tested many innovative new approaches to partnerships since the Fourth EPMR. • Partially in response to this Recommendation, ICRISAT commissioned a CCER on Partnerships and Information Management in 2000 to review and renew its strategy in this area. This CCER urged that partnership-building effort permeate all aspects of the Institutes' activities, enhanced by a consolidation of training and information-sharing functions into an Information Resource Management Programme (now the Information Resource Management Office). It also urged that the new Programme take on research activities to develop innovative approaches to enhance knowledge-sharing in support of partnerships. Such activities as setting up village electronic information centres to implement distance learning for drought preparedness and other information to empower them to overcome their poverty were implemented, with particularly strong leadership in developing ways to provide the poor with greater access to new digital technology – and the skills to make it valuable in their lives. This activity is evolving into a SAT Virtual University. • Related to the issue of the visiting scientist programme, the CCER led to a fundamental change of strategy towards to a greater emphasis on professional development - promoting learning rather than simply training. The new approach encourages learning-by-doing through direct internships of NARS scientists as active partners in major Centre research projects. This gives NARS the practical skills they increasingly need in an increasingly project-driven, competitive funding environment. The Institute established a new Learning Systems Unit headed by an IRS position to implement this approach. • An exciting example of the broadening of partnerships has been ICRISAT's catalytic role in bringing traditionally-isolated partners together from the public, private and NGO sectors. This work, much of it situated in Africa, stems from the realization that input supply channels and output markets, largely in the private sector, are key in achieving impacts from the research products generated in the public sector. Examples include the 'Sahelian Eco-farm' initiative to help farmers create more sustainable faming systems by diversify farming towards high-value crops in Niger and neighboring countries; an alliance in Southern Africa to improve farmers' access to seeds and food processors' investments in the utilization of sorghum and millet; and alliances in the Horn of Africa with the NGOs Technoserve and Catholic Relief Services to improve market outlets and seed supplies. • Major innovation in partnerships with the private sector are noteworthy. Many seed companies in India (and one in Egypt) now literally 'buy into' ICRISAT research by funding as well as actively partnering in developing new genetic systems (e.g. cytoplasmic male sterility in pigeonpea) and in advanced breeding line development. There are few comparable partnership examples in the CGIAR. • New partnerships with regional philanthropic foundations and trusts are equally noteworthy. These capitalize on ICRISAT's longstanding good relationships and record of achievement in the host country of India. The Sir Dorabji Tata Trust is helping support integrated watershed management research; and the Sehgal Foundation is contributing to sorghum and pearl millet improvement research. • Local government linkages are also bearing fruit: The Govt. of Andhra Pradesh (India) has contracted ICRISAT (using funds from a DFID project) for the technical backstopping of watershed-based research. ICRISAT has also established partnership with the poultry feed and alcohol industries in Andhra Pradesh to catalyse alternative uses for sorghum and millet.

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	• Partnerships with sister CGIAR Centres and with advanced research institutions are being substantially broadened and strengthened through the CGIAR Challenge Programme (CP) mechanism. ICRISAT is co-leader (with ICARDA) of the Desertification, Drought, Poverty and Agriculture (DDPA) to develop a CP, and a major participant in the Biofortification and Water CPs, as well as partners in the Genetic Resources and sub-Saharan Africa CP candidates. **Panel's comments:** ICRISAT accepted and implemented this recommendation aggressively and innovatively. Some traditional concerns of partnerships between IARCs and NARS still exist. The Panel is not convinced that the Centre always fully analyses its comparative advantage in its partnerships and is concerned that the Centre be cognizant of the full implications of the current strategy with regard to delivery of IPGs and resources. The Panel notes ICRISAT's efforts to expand its range of partners. However, ICRISAT needs to define the appropriate terms of engagements in every partnership, guided by the issue of comparative advantage and ability to deliver IPGs.
6. Because the Board must deal with declining resources requiring careful assessment of priorities; because of major impending changes in the ICRISAT management; and because of shortcomings in Board oversight since the last EPMR (which highlighted the same problem) the Panel **recommends** that the Board be diligent in its basic functions of providing financial and management oversight, setting vision, strategy and policy; and constituting its membership in a manner appropriate to the task.	**Response:** ICRISAT concurs. The Board is fully aware of its responsibilities and has taken the necessary stepslmeasures attendant to this recommendation as being manifested during the February Board meeting and particularly in the MTP for 1998-2000 and beyond. **Actions taken:** • **Being diligent in setting vision, strategy and policy:** The Board has been proactive in encouraging the management to be responsive to the changing global scenario and stakeholder expectations by reorienting the institutional Vision and Strategy appropriately. This has led to the crafting of the new long-term Vision and Strategy document to guide ICRISAT through the crucial period up to the year 2010. The Board's leadership in setting research priorities is reflected in its role in motivating Management to commission the "SAT Futures" document based on extensive stakeholder and partner consultations which was a significant input into the formulation of the long-term Vision and Strategy. Furthermore, the Board motivated Management to adopt a flatter research management structure. The Research Programmes were restructured into six Global Research Themes. As well, to ensure that research priorities are based on effective impact analysis, an Impact Assessment Unit has been established in GT 6. • **Being diligent in its basic functions of providing financial and management oversight:** The Board has been alert and proactive in continuously monitoring the financial situation, resource mobilization trends, and the crucial need to achieve a balanced budget. The Governing Board exercises effective financial oversight through its Finance Committee, carefully reviewing mandatory quarterly reports from management and giving appropriate instructions to the management. The three pillars of this policy are: a balanced budget, cash-flow management, and maintenance of an adequate level of reserves. The Board has been specifically instructing the management to come up with a balanced budget each year. In the event of difficulty in balancing the budget, the Board instructs the management to initiate cost-management measures so that expenses stay within available resources, thereby enabling balancing of the budget. The Board authorized two major staff rationalization exercises, one in 1997 and the other in 2002 with a view to ensuring the

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	long-term viability of the Institute. In 2002, the Board approved a rigorous cost-management programme to cope with the funding shortfall. As a result of these actions, surpluses were posted in 1997, 1998 and 2000, while deficits in 1999, 2001 and 2002 were contained within manageable limits, despite unforeseen funding cuts made by certain donors. • The Board approved a comprehensive Planning and Budgeting System to make budgeting and budget monitoring a transparent, needs-based process within the confines of resource availability. This would ensure that the resources are allocated judiciously and in line with the institutional priorities. • The Board has also been constantly monitoring liquidity management. In response to the Board's instructions, the management has put in place a comprehensive investment policy for managing the cash reserves in a manner so as to ensure maximization of returns on investment without compromising the safety of funds. The Board has also set strict benchmarks for maintaining operating and capital reserves (at the highest level among the CGIAR centres), which is constantly monitored. • In order to assist the Board in fulfilling its oversight responsibilities relating to the institute's internal control structure and financial reporting practices, an Audit Committee was set up in 1997. Under instructions from the Board, the practice of the external auditors carrying out the internal audit also was discontinued and an internal auditing function was set up within ICRISAT. The Audit Committee provides an open avenue of communication between the Governing Board, Management, and the function of internal audit. The Board has introduced risk-management as a concept to be incorporated into the internal audit plan, which is approved by the Board each year. • The Board has responded to declining resources by motivating Management to consolidate research sites in Africa, but not at the cost of effecting the balance of research resources or efforts between Africa and Asia. There has been consolidation into three regional hubs in Africa, conforming to the three NARS subregional research coordination bodies, WECARD/CORAF (Niamey), ASARECA (Nairobi), and SADC (Bulawayo). This regional arrangement supports the regionalization efforts demanded by the NARS and endorsed by the CGIAR. • HRD issues in particular have received critical attention. The Board instructed the management to revamp the Personnel Policies and put in place a new Performance Management System with teamwork, excellence and competency as its cornerstones. • The Board's diligence in providing management oversight is also reflected in the debates within the Board and the resulting high quality of outputs/products, including MTPs, as recognized by TAC/iSC, and the award to ICRISAT of its second and third King Baudouin Awards in recent years (see details in response to Rec. 9). • **Constituting the board membership in a manner appropriate to the above tasks**: All these efforts are reinforced by the manner in which the Board membership is being strengthened by providing the requisite expertise to implement ICRISAT's vision. The Board has on it a diverse blend of expertise relevant to the research agenda. It is particularly strong in the area of biotechnology, while maintaining a healthy gender balance (now three women) and geographical distribution reflecting the global spread of semi-arid tropics. African membership on the Board has now been raised to three. Private sector experience has also been incorporated into Board membership to strengthen its business perceptions. • **Panel's comments:**

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	The recommendation was accepted. With respect to research oversight, the Board continued to complain that it was not getting adequate information and had lost oversight (1998 & 1999). The situation seems to have improved in the past few years with a flatter management with clearer reporting lines and a rudimentary Vision and Strategy in place.
7. Because the Institute has focused so much in the recent past on planning mechanisms and organizational structure, at the cost of effective research management and efficient decision making, the Panel **recommends** that, in the coming years, management pay due attention to the following prerequisites of good research management: effective management information systems for adequate planning, budgeting and monitoring, heightened cost-consciousness; appropriate management skills; effective teamwork, and transparent performance appraisal and accountability systems at ICRISAT.	**Response:** ICRISAT concurs. The Centre has already taken concrete action to respond to this recommendation, including management information systems and transparent performance appraisals. **Actions taken:** There have been numerous improvements in management systems and capacities since the Fourth EPMR. • Management skills and teamwork: ❑ With assistance from the consulting firm TRG, two leadership and team-building workshops were conducted for Senior Staff during 2001 & 2002 on building collaborative alliances and teamwork both within and beyond ICRISAT. ❑ Teamwork training was extended to local professional, technical, and administrative staff with the help of highly-reputed local consultants. ❑ For stimulating creativity, enhancing participation and building broad consensus the following have been initiated: ▪ 'Scientist-Managers Dialogue' forum to bridge the gap between research and non-research staff communities. ▪ E-Dialog, an internet based virtual forum, for all staff across locations to articulate and build on views on topical issues. ▪ Crazy Idea Hour to provide a space for creative and innovative ideas. • Management committee structure: the structure was revised in 2001 to provide greater clarity and time-efficiency, with the single large Management Committee being divided into a smaller Management Group (MG) supported by close interaction and representative membership from a Research Committee, and an Administration and Operations Committee. • Based on the new long-term Vision and Strategy for the institute, the Board motivated Management to adopt a flatter research management structure. The Research Programmes were eliminated and six Global Themes were put in place. As well, to ensure that research priorities are based on effective impact analysis, an Impact Assessment Office was established. • Budget Planning & Monitoring: A new Planning and Budgeting System places strategic research planning at the core of the planning process. Funds are allocated based on priority research activities rather than an extrapolation of the previous year's budget. Priority activities are determined through an institute-wide Annual Work planning Meeting feeding into the deliberations of the Research Committee and Management Committee, in consultation with Theme Leaders. A robust Budget Status Reporting System (BSRS) is available online, helping budget holders keep track of actual expenses against their budgets. • Performance Management: the former staff evaluation system has been updated and enhanced into a Performance Management System (PMS). For scientists and managers an annual work plan now forms the basis for performance evaluation. The appraisal process is transparent and encourages staff to share and receive positive and developmental feedback. Reward decisions are based on merit and quantitative indicators measured through the PMS. The PMS is being

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	currently reviewed to make it participatory rather than 'appraiser-appraisee based', including upward as well as downward appraisals. • Information systems: ICRISAT has developed a number of management information systems that are increasing research management efficiency. Annual project activity reports and mid-term activity reports are stored in a searchable database made available on the internet and intranet. A project budget reporting system, trip reporting system, and research highlights system (including research and policy briefs) have also been developed. • Cost Management: to enhance cost consciousness among staff, data on costs are shared with staff and discussed in focus groups. Suggestions received from these discussions are taken up for consideration and implementation by the MG. A cost management task force has been constituted to review costs on various activities across the Institute. Implementation of the recommendations of the task force has yielded considerable savings in procurement, travel, energy, and communication.
8. Because, following the retirement of the current incumbent, recruitment for the DDG position is now underway, and several other senior managers are leaving the Institute within the next few months, the Panel is very concerned that the management not be further weakened during the upcoming transition period, and that a strong team of senior managers be constituted as soon as possible; and irrespective of the pressures to fill the position of DDG, and in view of the changes the Institute will have to face in the coming years in its move towards the 'new' ICRISAT, the Panel **recommends** that the selection of the new DDG be deferred until the new DG has joined and can participate fully in the recruitment process, and that a strong transition team of interim DDG and DG be put in place by the Board as soon as possible.	**Response:** Accepted. **Action taken:** The Board deferred the DDG recruitment until the DG designate was identified. **Panel's comments:** The issue is mute.
9. Because the next few years will require enlightened and decisive	**Response:** ICRISAT accepts the recommendation.

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management of ICRISAT, and as the Institute gears itself for the proposed revitalization, the Panel **recommends** that the management and Board provide adequate leadership to the Centre by nurturing an institutional culture that encourages scientific and managerial excellence, and by ensuring the effective management of financial, human and other resources of the Institute.	**Actions taken:** Since the Fourth EPMR, Management and the Governing Board have undertaken numerous initiatives to encourage and reward a culture of scientific and managerial excellence at ICRISAT. ▪ Management staff underwent leadership and management training courses in 2001 & 2002 (described earlier in Rec. 7). Four IRS/SMG women staff members have attended several CGIAR Women's Leadership Courses. Two strategic marketing workshops were conducted and over 40 Scientists and Managers benefited from the programme. ▪ To recognize scientific and managerial excellence, ICRISAT recently established "ICRISAT Millennium Science Awards" for: a) Outstanding partnership project b) Outstanding scientist c) Outstanding young scientist d) Outstanding support team e) Best scientific article ▪ Management has increased the frequency of the 'Doreen Mashler Award for scientific excellence of teams' to an annual basis. ▪ An indicator of scientific excellence in which ICRISAT takes great pride, has been its winning of three of the past four King Baudouin Awards – the CGIAR System's highest accolade. Two of these three occurred since the Fourth EPMR. Only one other Centre (IITA) has won as many. ICRISAT staff members have also captured CGIAR Outstanding Scientist awards. ▪ Towards more effective management of human resources, much effort has gone into improving staff grading, evaluation and reward systems for both the international/local-professional (IRS/SMG), and the local (NRS) staff cadres. The new system is transparent and rigorously derived. All jobs were carefully reviewed, ranked, and categorized in consultation with staff, by job grading committees. ▪ A Personnel Policy Manual (PPM), and Personnel Administrative Manuals (PPMs) to guide the regional implementation of the PPM, have been developed through in-depth consultations with staff and careful deliberation by Management and the Board. These manuals provide both managers and staff with greater transparency and confidence in managing their relations. **Panel's comments:** The Panel is satisfied with the changes made, though here again, the initiatives were not taken until 3 years after the EPMR .
10. The Panel is convinced that the next few years hold considerable promise for ICRISAT, provided the changes proposed in this Report are implemented effectively; and in view	**Response:** We agree, on the understanding that this is to be a status review on the progress that has been made based upon our approved Medium Term Plan, which incorporates the accepted recommendations of the EPMR. **Action taken:** Based on progress achieved to date and the strain of time and resources this would have required, TAC waived this expectation.

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of the CGIAR community's interest in the continued success of the Institute, the Panel **recommends** that a Mid-Term Review of ICRISAT be undertaken by the CGIAR in two years (i.e. completed by end 1998) to assess the progress made by the Institute in transforming itself into a 'new' strategic research and partnership-oriented centre of excellence.	**Panel's comments:** The Panel agrees with TAC's decision to not review the Centre again after two years but considers the postponement of the EPR unfortunate.

APPENDIX VI

LIST OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ADG	Assistant Director General
AGL	Applied Genomics Laboratory
AMG	African Market Garden
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARI	Agricultural Research Institute
ARO	Agricultural Research Organization
BoT	Board of Trustees
CBC	Committee of Board Chairs
CCER	Centre Commissioned External Review
CDC	Centre Director's Committee
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Centre for International Forestry Research
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement
CLAN	Cereals and Legumes Asia Network
DDG	Deputy Director General
DG	Director General
DMP	Desert Margins Programme
DNA	Deoxyribonucleic Acid
ELISA	Enzyme Linked Immune Serological Assay
ELS	early leafspot
EPMR	External Programme and Management Review
EPR	External Programme Review
FAO	Food and Agriculture Organization of the United Nations
FSR	Farming Systems Research
FTO	Freedom to Operate
GDP	Gross domestic product
GEF	Global Environment Fund
GIS	Geographic information system
GITA	Global Impact Target Area
GLP	Good Laboratory Practice
GRAV	Groundnut Rosette Assistor Virus
GREP	Genetic Resources and Enhancement Programme
GT1 - 6	Global Research Theme 1 - 6
GTL	Global Theme Leader
GTs	Global Research Themes
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
HQ	Headquarters
IAC	ICRISAT Asia Centre
IAO	Impact Assessment Office
IARC	International agricultural research centre
ICAR	Indian Council for Agricultural Research
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICLARM	Worldfish Centre
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics

ICT	Information and Communication Technology
ICW	International Centres Week
IDM	Integrated Disease Management
IDRC	International Development Research Centre
IF	impact factor
IFDC	International Fertilizer Development Centre
IFPRI	International Food Policy Research Institute
IIMI	International Irrigation Management Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INIBAP	International Network for the Improvement of Banana and Plantain
INRM	Integrated Natural Resources Management
INTSORMIL	International Sorghum and Millet Collaborative Research Support Project
IP	Intellectual Property
IPCV	Indian Peanut Clump Virus
IPG	International public good
IPM	Integrated Pest Management
IPM	Integrated Pest Management
IRMO	Information Resource Management Office
IRMP	Information Resource Management Programme
IRRI	International Rice Research Institute
IRS	internationally recruited staff
iSC	interim Science Council
ISC	ICRISAT Sahelian Centre
ISI	Institute for Scientific Information
ISNAR	International Service for National Agricultural Research
IT	Information Technology
IWMI	International Water Management Institute
LAC	Latin America and the Caribbean
LDS	Library and Documentation Services
LLS	late leafspot
LSU	Learning Systems Unit
MAS	Marker-Assisted Selection
MTM	Mid-term Meeting
MTP	Medium Term Plan
NARES	National agricultural research and extension system
NARS	National agricultural research system
NBPGR	National Board for Plant Genetic Resources
NGO	non-governmental organization
NPG	National Public Good
NRM	Natural Resource Management
NRMP	Natural Resource Management Programme
O&M	Organization and management
OFR	On-farm research
PAO	Public Awareness Office
PC	Programme Committee of the Board
PDMO	Project Development and Marketing Office
PGRE	Plant Genetic Resources and Enhancement

PY	person years
R&D	Research and Development
RED	Regional Executive Director
REIA	Research Evaluation and Impact Assessment
RITA	Regional Impact Target Area
RMO	Resource Mobilization Office
RRS	regionally recruited staff
SA	South Asia
SAT	Semi-arid tropics
SEA	Southern Eastern Africa
SEF	Sahelian Eco-Farm
SEPP	Socioeconomics and Policy Programme
SINGER	Systemwide Information Network for Genetic Resources
SMINET	Sorghum and Millet network
SMIP	Sorghum and Millet Improvement Programme
SRO	subregional organization
SSA	sub-Saharan Africa
TAC	Technical Advisory Committee
TAFP	Training and Fellowships Programme
TEC	Technical Exchange Committee
TSBF	Tropical Soils and Biological Fertility
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
VLS	Village Level Studies
VUSAT	Virtual University for the Semi-Arid Tropics
WARDA	West Africa Rice Development Association
WCA	West and Central Africa
WEHAB	Water, Energy, Health, Agriculture and Biodiversity