



SCIENCE COUNCIL

CGIAR

REPORT OF THE  
FIFTH EXTERNAL  
PROGRAM AND  
MANAGEMENT REVIEW  
OF THE CENTRO  
INTERNACIONAL DE  
MEJORAMIENTO DE MAIZ  
Y TRIGO (CIMMYT)

This document contains:

- Extract of the proceedings of AGM05
- SC Commentary
- CIMMYT Response
- Report of the External Review Panel and Annexes

**APRIL 2006**

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH



CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH  
SCIENCE COUNCIL AND CGIAR SECRETARIAT

**Report of the  
Fifth External Program and Management Review (EPMR)  
of the Centro Internacional de Mejoramiento de Maiz y Trigo  
(CIMMYT )**

**Review Panel** Don Marshall (Chair)  
Eugenio J. Cap  
Shu Fukai  
Peter G. Goertz  
Maureen K. Robinson  
Edward N. Sayegh

Sirkka Immonen (SC Secretariat)

SCIENCE COUNCIL SECRETARIAT

APRIL 2006





## Consultative Group on International Agricultural Research (CGIAR)

### CGIAR Annual General Meeting, 2005 (AGM05)

#### **External Program and Management Review of CIMMYT<sup>1</sup>**

The Chair noted that ExCo had a full discussion of the EPMR report at its meeting in May 2005.

EPMR Panel Chair Donald Marshall presented a summary of the findings and recommendations of the CIMMYT EPMR. He noted that CIMMYT was undergoing a major transformation at the time of the review. He highlighted the following major findings of the Review Panel:

- Deficiencies in strategic planning,
- Failed financial oversight by the Board,
- Lack of a financial management system and project management system,
- Lack of critical mass of plant breeding expertise,
- low staff morale.

However, he noted that despite the above major problems, CIMMYT has maintained the production of high quality research outputs and continued to contribute to positive impacts on agriculture of developing countries. In the Panel's view, there is a compelling case for continuing support to CIMMYT.

Indicating agreement with the Panel's conclusions and recommendations, SC Chair Per Pinstrup-Andersen highlighted key points in the SC's commentary. He pointed out the importance of monitoring the implementation of EPMR recommendations, noting that the problems subsequently faced by CIMMYT might have been avoided if the recommendations of the Center's 4<sup>th</sup> EPMR were implemented. The SC emphasized the importance of translating CIMMYT's strategic plan into a more detailed business plan as recommended by the Panel. The SC was pleased to see that CIMMYT has responded to this recommendation and is looking forward to implementing the newly developed business plan next year.

In its commentary, the CGIAR Secretariat reiterated its endorsement of the Panel's recommendations on governance and management. It further highlighted the need for a better balance in providing oversight responsibilities for Centers' research and for its management and finance. The need for close monitoring of EPMR recommendations was highlighted.

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<sup>1</sup> Extract of Summary Record of Proceedings, CGIAR Annual General Meeting, Business, Meeting, 7-8 December 2005, Marrakech, Morocco



## **Consultative Group on International Agricultural Research (CGIAR)**

### **CGIAR Annual General Meeting, 2005 (AGM05)**

CIMMYT Board Chair Lene Lange and DG Masa Iwanaga gave presentations focusing on what CIMMYT has accomplished so far in response to the recommendations of the EPMR. Of the 23 recommendations, they reported that more than half have either been implemented or are in the process of being implemented. The following were highlighted:

- a. Agreement by the Board on a new governance system for CIMMYT, key features of which include a focus on key Board functions, a smaller Board size with new skills added, more frequent meetings, and transparent and participatory agenda setting.
- b. Completion of a detailed business plan to be implemented in 2006.
- c. Management information systems being put in place.
- d. Improvement in liquidity (significant increase in the Center's reserves).
- e. Significant progress in forging partnerships with other CGIAR Centers, i.e. with ICARDA on wheat research in CWANA region, and with IRRI on three programs.

#### ***Discussion:***

- Members were generally pleased with the progress that has been made and encouraged the Center to continue to undertake the changes recommended by the EPMR Panel.
- The breakdown in the Board's oversight of finance was not only due to the lack of financial management expertise on the Board. It could also be attributed to the way in which Board members (in CGIAR Centers) were selected, i.e. often by existing Board members and DGs.
- EPMRs have a basic limitation as a component of the CGIAR's monitoring and evaluation process in that they are conducted only every five years or so. This emphasizes the need to complement it with an annual performance monitoring system.
- There is a need for the monitoring and evaluation system to go beyond the institutional EPMRs.
- There is a need to balance the objective of building up the Center's reserves and rebuilding its staff capacity.
- CIMMYT's work in LAC has significantly decreased. National programs in the region could benefit more from CIMMYT's work, particularly from its pre-breeding activities.

#### ***Decisions:***

- The CGIAR endorsed the CIMMYT EPMR recommendations.
- Members expressed appreciation for CIMMYT's response and gave encouragement to the Center as it proceeds with reforms.
- The SC and CGIAR Secretariat should draw out lessons in terms of practices that go beyond a particular Center that might be of more general applicability across the System.

## **SC Commentary on the Fifth External Program and Management Review of CIMMYT**

The Report of the Fifth External Program and Management Review (EPMR) of CIMMYT was discussed at SC3 at IWMI headquarters in Colombo, Sri Lanka, in the presence of the Panel Chair Dr. Don Marshall, Chair of CIMMYT's Board of Trustees Dr. Alex McCalla, and the CIMMYT DG, Dr. Masa Iwanaga. The Science Council (SC) expresses its appreciation to Dr. Don Marshall and his Panel for a critical Report, which provides a frank and constructive assessment of all aspects of the Center's operations. The Panel report incorporates comments and analysis from both a prospective and a retrospective point of view. The SC notes with appreciation that CIMMYT considers this report of high quality, timely and useful at a time of transition and broadly agrees with the EPMR Panel's assessment and recommendations. The Center has already initiated action to implement the recommendations. The Report contains twenty three recommendations and several important suggestions in the various chapters. The SC endorses the Panel's recommendations and provides the following commentary to complement the Report.

### **Introduction**

The Panel began by looking at the implementation of the agreed recommendations from the 4th CIMMYT EPMR in 1998 and found that several recommendations have been left unimplemented. This has affected the operations of CIMMYT and provides strong reasons for the System to urgently put in place a coherent follow-through monitoring and evaluation (M&E) mechanism to reinforce a higher sense of accountability at the Center governance and management levels. Such steps have been taken in the annual performance measurement and Medium Term Plan assessment now being implemented at the System level. The SC fully agrees with the Panel that the Center has born a high cost of serious shortfalls in governance and management, clearly documented in the report, some of which stem from the failure to implement past recommendations.

Due to financial failure which reached a critical point at the end of 2002, CIMMYT has gone through turmoil, including three staff downsizings implemented at the same time it was engaged in strategic planning and major programmatic restructuring. The effects of this are reflected in the responses to a staff survey conducted by the Panel. The SC shares the EPMR Panel's concern that low staff morale is one of the gravest problems that the Center needs to address urgently. Any further downsizing of staff could hurt the research programs seriously.

The Panel concluded that CIMMYT's unique experience and capacity in genetic enhancement of two of the world's major crops for poor environments and traits needed by the poor is the main justification for its existence. The Panel was concerned that this capacity is being eroded through a) a shift of resources away from plant breeding to other activities to implement the livelihoods based programs of the new CIMMYT strategy; and b) a slow uptake and use of modern breeding methods that eventually could justify change in staff patterns. The SC agrees with these concerns of the Panel.

## **Strategic plan**

Panel considered CIMMYT's new strategic plan weak and lacking in direction and goals for implementation, despite the participatory process that the Center followed in developing the plan. Thus, in the Panel's assessment, in trying to cover a very broad agenda, CIMMYT has overly de-emphasised germplasm enhancement in its strategic plan. The SC fears that CIMMYT is ceasing to promote its comparative advantage in crop improvement in the broad sense in its strategic plan for what ever reasons, one of which could be the declining investment by donors to support a program based on strong genetic enhancement component. The SC wishes to re-emphasise to all stakeholders the critical and vital role of germplasm-based gains in productivity, maintenance of past gains and risk avoidance in the overall strategies of the CGIAR.

The SC strongly cautions the Center from diversifying away from its core competence in genetic enhancement to areas where several other Centers and other organizations are working, such as crop-livestock interactions, INRM and addressing livelihoods broadly, and to areas beyond the CGIAR's priorities, such as putting in place national seed systems even though these activities may be linked to increasing maize and wheat productivity and subsequent poverty alleviation. Thus in reorienting its programs, CIMMYT should seek more engagement with others to provide the "livelihood" setting and outcomes in which CIMMYT focuses on the crop improvement. This is particularly important in regions such as CWANA where another Center can provide the livelihood inputs for the program. The Panel noted that CIMMYT unfortunately appears to be expanding its livelihoods agenda in this region at the expense of crop improvement.

## **Inter- Center relationships**

It is important that the CGIAR System as a whole be seen to be working in a co-ordinated way towards a single mission. CIMMYT's long-running disagreement with ICARDA, as highlighted by the Panel, over responsibility for wheat and barley breeding in the CWANA region is counter-productive and, therefore, must cease at the earliest possible time. The SC sees the inter-Center planning meetings that have already taken place as steps in the right direction. However, in the SC's view, the assertion by both Centers that resolution will take time, simply because the dispute has been ongoing for many years, is not acceptable. The SC expects to see an indication of enhanced collaboration in the respective Center's MTPs for 2006-8.

## **Research programs**

The SC joins the Panel in commending CIMMYT for its efforts to integrate its research in the new program structure, which has broken down the strong "silos" of the crop and discipline programs of the old CIMMYT. The previous sharp split of activities into disciplinary programs in maize, wheat, biotechnology, NRM and economics, including a split even in the gene bank and in training into separate maize and wheat units, has not helped the Center to develop new research approaches and promote best practices in areas such as database management. The new structure should enhance the internal collaboration between breeding and biotechnology, which the SC considers imperative. The SC is also pleased to

note that CIMMYT has been able to attract highly qualified new staff to the program leader positions.

The SC is pleased that the Panel's assessment of CIMMYT's past research performance is by and large positive. The Panel's negative analysis of CIMMYT's publication record over the review period should, however, be addressed. CIMMYT has demonstrated impact in all areas of past research. CIMMYT's efforts in maintenance breeding have been invaluable securing and advancing yield gains through breeding against the main biotic and abiotic stresses. CIMMYT needs to maintain an adequate level of activity in maintenance breeding.

The SC shares the Panel's concern that CIMMYT has not been able to modernise its facilities due to lack of investment, and that areas such as data management and biotechnology capacity require substantial investments to be sufficient for the Center's needs. The uptake of modern breeding methods has stagnated at CIMMYT in recent years, and one reason seems to have been the costing structure of projects, which has favoured labour-based approaches and penalised use of modern breeding tools. CIMMYT cannot assume that introduction of new breeding tools is immediately going to ease the requirement for breeder capacity at the Center. Experienced breeders are key in implementing the shift from the conventional approaches to incorporation of new breeding tools that will eventually enhance efficiency.

CIMMYT should more carefully assess the involvement of alternative suppliers, the private sector in particular, for maize in the favoured areas in Asia and Latin America, and the strong wheat programs in many countries. The Center needs to identify its specific niche in wheat and maize related research targeting areas where past research has not made a change and addressing pressing problems also in favourable areas if it has a comparative advantage. The SC raises some questions related to the continuation of the QPM breeding for human consumption without clear evidence of nutritional and other benefits. Although CIMMYT is planning to incorporate the QPM trait to all materials with other useful characteristics, and there are benefits to animals from high lysine and tryptophan, this work does not seem to warrant the additional investment which is needed, as the trait is not simple to manage, and does involve possible trade-offs with other traits.

Although the Panel considered CIMMYT's work in economics of high quality particularly in demonstrating past impact, it noted the total lack of ex ante impact assessment. This is also the SC's concern and it does not regard the Resource Allocation Tool as a substitute for more explicit ex ante impact assessments. It is particularly critical for guiding decisions regarding research into marginal areas and targeting resource poor farmers and other choices to determine optimal balance between different activities. The SC feels that not implementing the 4th EPMR's recommendations on the Economics Program has been a serious omission as these recommendations are still valid.

## **Management**

As previously noted, CIMMYT has failed to implement any of the 4th EPMR recommendations related to management. The report gives a grim account of the financial mismanagement since 1998 which led the Center to near collapse in 2002. It appears that funds went to overly ambitious research programs at the will of research leaders with

inadequate monitoring, and corporate, financial and human resources management components were neglected.

CIMMYT faces great challenges in attempting to build up again its reserves. It still needs to make priority decisions in order to enhance the scientific infrastructure. The SC strongly feels that a weak CIMMYT is a loss to the entire CGIAR System. The SC is sympathetic to the Centers determination to run a positive balance through savings. However, the SC is highly concerned about the continuing seriousness of CIMMYT's financial challenges.

### **Governance**

In addition to its analysis of the performance of the Board, the Panel provided a think piece on a governance model for CIMMYT and the CGIAR Centers in general. This includes a significantly smaller Board than is currently the practice, with emphasis on corporate and financial management oversight reflected in the Board members' expertise areas along with more frequent virtual and face-to-face meetings. The Center Board and Management fundamentally agree with this perspective. The SC emphasises that with any such model, the Boards would still need to assume principal oversight responsibility for all Center management, including program quality and relevance. Board commissioned CCERs are a central tool for carrying out this oversight responsibility.

The SC agrees with the Panel that the Center needs to be clear about its responsibilities regarding the Generation Challenge Program (GCP) that it hosts. It is very positive that the CP seems to have stimulated collaboration among researchers in different Centers.

### **Conclusions**

In the absence of a clearly articulated operational strategy, the SC considers it urgent that the Center, with full involvement of its new Program leaders, completes a strategic business plan to implement the new strategy. This should be reflected clearly in the Center's Medium-term Plan for 2006-8. Furthermore, the implementation of the matrix management structure requires that the Center has in place best management practices.

The SC suggests that given the many challenges CIMMYT faces regarding the financial situation, staff morale, management of the new program matrix, further development of programs and implementation of the new strategic plan, the Center be reviewed after one year rather than two years as recommended by the Panel. This review should be accompanied by a site visit and include the Panel Chair. This is particularly relevant for monitoring improvement with staff morale. At the time of the review the Center needs to have its program of work developed involving the new program leaders, have Board reform completed, and show evidence of progress as measured by critical indicators on all aspects of management.

## **CGIAR Secretariat Comments on the Governance and Management Aspects of the CIMMYT EPMR Report**

The review points to the failure of governance as a major reason for the severe crisis faced by CIMMYT. Continuing financial difficulty, low staff morale, and overall uncertainty are key concerns highlighted by the EPMR Panel.

The Panel's findings emphasize the critical importance of oversight of the Center's operations. Ensuring the implementation of CGIAR-endorsed EPMR recommendations is a major responsibility of CIMMYT's Board and management. Had the recommendations of the 4th CIMMYT EPMR on governance and management been implemented, perhaps the current financial crisis would have been averted. Recently the CGIAR Executive Council began to monitor the implementation of EPMR recommendations, which may flag non-compliance with CGIAR-agreed EPMR recommendations in a more timely manner. It should be noted that ExCo also alerted the Center in 2003 about CIMMYT's poor financial performance and requested remedial action.

We support the recommendations of the Panel on governance and management. We note that CIMMYT has agreed to all but one of them (i.e., creation of a governance committee) and has initiated changes to improve the governance processes. In our view, the recommendations point to the need for the Board to re-examine how it handles business. The Panel's suggestions contained in Appendix VII (Re-thinking Governance in CGIAR Centers) of the report could be helpful for this purpose.

One specific area of reform that we would like to highlight relates to Board's role in providing oversight of research and quality of science. We agree with the SC that, fundamentally, this is a major responsibility of the Board. Oversight of management and finance is an equally fundamental responsibility. The Board needs to decide how it would carry these fundamental responsibilities. In some cases the Board need not provide direct oversight itself, so long as it puts in place mechanisms that facilitate adequate and timely oversight. The Panel makes suggestions on such mechanisms which complement CGIAR evaluation and monitoring processes such as the EPMRs, MTPs, and PM.

A better balance of oversight responsibilities would enable the Board to have a greater opportunity to focus on other strategic concerns such as re-building CIMMYT's image, fund raising and financial planning, improving the Center's efficiency, establishing new partnerships, etc. In this connection, we take note of the Panel's conclusion that "CIMMYT's Board lacks sufficient depth of expertise in financial analysis, in business management and in attracting new resources to provide an adequate level of informed oversight and support to management."

We are pleased to note that the Panel has reiterated the importance of an orientation and learning process for new Center Board members. Orientation programs at the System level are available, and one specifically suited to the Center should be a key component of CIMMYT's governance improvement process.

We would like to clarify two specific statements made by the Panel in Section 1.2.2 of the Report:

The Panel states that “the rapid erosion of core support for the Centers by donor agencies over the 1990s and its only partial replacement by special project funding... has been exacerbated by the development of CPs...” The recent analysis of the pilot CP experience (“Synthesis of Lessons Learned from Initial Implementation of CGIAR Pilot Challenge Programs” at [http://www.cgiar.org/pdf/agm04/agm04\\_cp\\_lessons.pdf](http://www.cgiar.org/pdf/agm04/agm04_cp_lessons.pdf)) shows that the CGIAR’s overall funding has been on the upswing since 2001 and that core support has not been affected by the development of CPs.

The Panel cites “...linking part of the World Bank contribution to Centers to the level of funds raised” as another reason for “erosion of core support.” In fact, the Bank has been increasingly “de-linking” its contributions to Centers to the level of funds raised from other donors (i.e., “matching”). In recent years the trend has been to decrease the percentage of the Bank’s contribution provided on a matching basis.

In conclusion, the CGIAR Secretariat commends the EPMR Panel for a thorough evaluation of CIMMYT’s programs and management. This EPMR provides yet another example of the significant impact governance, management and institutional health have on program performance. The depth of analysis provided in the areas of governance and management in this review is in part due to having two panel members devote their primary attention to these areas.

We recommend that ExCo and the CGIAR endorse the Panel’s recommendations on the governance and management of CIMMYT.



International Maize and Wheat  
Improvement Center  
Centro Internacional de  
Mejoramiento de Maíz y Trigo

*March 23, 2005*

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Dear Per and Francisco:

The CIMMYT Board and Management appreciate the efforts of the 5<sup>th</sup> EPMR Panel in assessing CIMMYT at a time the Center is under major transition. The report comes at an opportune time for the Center and we find the critical analysis and rich and constructive suggestions to be very helpful in addition to the 23 recommendations contained in the report. The Center's response to the Panel's recommendations and other general observations are attached to this letter.

The Center recognizes that in a number of key areas recommendations of the previous EPMR have been given inadequate attention. We also acknowledge that, in the past, governance procedures have been below international standards of best practice. The CIMMYT Board has recently initiated an ambitious and far-reaching process that will lead to a comprehensive reform of its system of governance.

The Center shares the view of the Panel that "the Centre is now poised to move forward into the future".

We firmly believe that the new vision for CIMMYT of linking pathways to poverty alleviation with improved and sustainable maize and wheat based farming systems, coupled with the undoubted excellence of CIMMYT's new senior management team and staff, augers well for the Center. We continue to look for more efficient means to deliver the outputs of our work so that they impact where needed most- in the households of poor families- and we stand ready to catalyze change processes in the CGIAR.

Finally, we urge donors to invest in the new CIMMYT.

Yours sincerely,

Masa Iwanaga  
Director General  
CIMMYT

Alexander McCalla  
Board Chair  
CIMMYT

## ***CIMMYT RESPONSE TO THE 5<sup>th</sup> EXTERNAL PROGRAMME and MANAGEMENT REVIEW***

The CIMMYT Board and Management take this opportunity to thank the 5<sup>th</sup> EPMP Panel for their time, effort and recommendations. The report is a vital part of the oversight of the Center and will help it ensure continued impact to its stakeholders in the future. Throughout, this response is a collective response of the Board and Management unless otherwise noted.

The Center recognizes that in a number of key areas recommendations of the previous external review have been given inadequate attention. While it would be easy to pass the responsibility for this failure to act to the financial crisis and prior administrations, it is appropriate for the Center Board and management to recognize these shortcomings and to take responsibility for appropriate remedial actions. In many areas such as performance evaluation, cost recovery systems, project management and computerised financial systems, the current Center management is actively working on these issues. We recognize that there has been an under-investment in these areas in the past and we will strive to make changes, with appropriate resourcing, in the short to medium term.

The Center shares the concerns of the Panel on staff morale, and also recognizes that various staff groups have lived through deep financial turmoil, significant staff downsizing and ongoing staff employment concerns associated both with the new alliance with IRRI and implementation of the new strategy. The Center also recognizes, as did the Panel that “despite the ongoing funding crisis... the panel was pleased to find that CIMMYT’s scientific staff continued to produce a range of outstanding outputs”.

CIMMYT is a world renowned scientific institution and as such attaches great importance to the relevance and quality of its science. The Center is encouraged by the positive comments of the panel regarding the “uniformly high quality of the newly appointed Directors”, and that the overall staff quality was ranked by the panel as good to very good. The comments of the panel on the complexities of implementing a program matrix structure are embraced by the Centre and we shall endeavor to instill as much clarity as possible into the various matrix roles.

The CIMMYT Board of Trustees found the Panel’s advice on governance particularly useful. The major preoccupation of the Board since 2002 has been the financial health of CIMMYT but the Board has also been aware that its governance procedures are below international standards of best practice. The Board has recently initiated an ambitious process that will lead to a comprehensive reform of its system of governance. The advice of the Panel has helped refine the thinking of the Board and we are certain that the results of this ongoing process will be a durable framework for the future.

In closing, CIMMYT thanks the Panel again for the professional attitude it showed during its work. The Center highly appreciates the critical analysis and rich and constructive suggestions made in the report. The Center’s Board has requested Management to report at the next meeting of the CIMMYT Board in November 2005 with an outline of progress towards implementing recommendations.

The Center acknowledges and shares the view of the Panel that “the future ahead for CIMMYT is very bright indeed”

## ***CHAPTER 2***

**General comments:** CIMMYT was pleased that the panel recognised that the Centre’s recent strategic planning process had brought together staff and members of the Board of Trustees to critically assess how CIMMYT could build on its historical strengths and remain relevant to its various stakeholders. We agree with the panel that the Centre has adopted a bold new vision and mission and that the strategic direction outlined in “Seeds of Innovation” needs to be fleshed out in a strategic business plan that, amongst other things, will assess the resource needs to implement the plan. A key part of this planning process which will occur throughout 2005 will be the development of a revised resource mobilisation strategy.

While CIMMYT concurs with the panel's judgement that current work is constrained by the restricted nature of CIMMYT's funding there are several excellent examples of projects that have attracted donor support that clearly align with the Seeds of Innovation strategy, including NSIMA ("New seed initiative for maize in Africa"); IRMA "Insect resistant maize for Africa: *Delivering products to farmers*"; and SOFESCA ("Soil fertility consortium for southern Africa"). These projects are strongly supported by the regional communities they serve as they are clearly having an impact on their lives. While it is undoubtedly true that a range of social and political factors will influence the extent to which CIMMYT can achieve its mission, CIMMYT believes that the success of programs such as the African Livelihoods Program demonstrates that the new strategy, when fully implemented, can have a profound effect on the lives of many of the world's poorest communities. As the panel has observed, the Director General has recruited an exceptionally talented team that will lead the implementation of the new strategy. CIMMYT believes this team has the skills and the commitment to lead the significant changes foreshadowed in Seeds of Innovation and to address the poor staff morale that has resulted from the major restructuring.

Clearly the focus in "Seeds of Innovation" on regionalisation of CIMMYT's activities places increased emphasis on both sub-Saharan Africa and South East Asia. The Center continues to seek new project activities, consistent with the strategy, to expand research and impact on poverty alleviation.

1. *The Panel recommends that senior management and programme directors undertake a much more rigorous process to define goals for the new strategy that provide a framework within which to organize projects and activities and against which progress in meeting the goals can be measured. In addition to strengthening the implementation of the new strategy, the process will enable the programme directors as a team to identify a set of goals that are congruent across the Centre.*

**CIMMYT agrees with the recommendation and plans to implement the required actions with immediate effect. The Center in its "Seeds of Innovation" document already has planned for such a set of goals and milestones to be developed during 2005, and for there to be a Center led review of the implementation by late 2006. "Seeds of Innovation" should be perceived as a vision document for the new strategy that is being implemented and will be complemented, as originally planned, by a supplemental plan document entitled "From vision to implementation"**

2. *The panel recommends that CIMMYT develop a business strategic plan that will support the successful implementation of the new strategy in the face of a dynamic financial environment.*

**CIMMYT agrees with the recommendation and sees the value in a business style strategic plan document. As with recommendation 1 the Center will begin implementation of this recommendation with immediate effect. A business strategic plan that brings into full operation the "Seeds of Innovation" vision will clearly and explicitly state program goals, milestones, deliverables, focus and balance. The document will also show clear linkages between the setting of institution and program goals, resource mobilization and program budgets. This exercise is also very closely linked to the development of our next MTP (2006-2008) and attendant financing and resource mobilization plans.**

3. *The panel recommends that CIMMYT management and board undertake a mid-term review in 2007 focused on the implementation of the new strategy, the efficacy of CIMMYT's reorganization and the impact of financial capacity on CIMMYT's programmes and operations.*

**CIMMYT agrees with the recommendation.**

### CHAPTER 3

**General comments: Overall, the Center found this chapter to be less useful than the report as a whole for two (2) main reasons:**

- 3.1. Some complex issues are not fully analysed. For example, the Panel refers to the release of drought tolerant maize OPVs for sub-Saharan Africa and the potential for their cultivation on 1M hectares but questions whether any smallholder farmers grow this material (p27). This analysis does not take into account the considerable role of NGOs in distributing seed to smallholder families and the remarkable increase in the use of improved OPVs in the region.
- 3.2. There appears to be uneven and inconsistent use of CCERs conducted by the Center during 2004. The recommendations of the wheat CCER are largely reflected by the Panel however, in the case of the maize CCER, the conclusions of the Panel do not take into account the CCER report. Furthermore, some of the findings of the Panel on maize research are incomplete and, apparently, contradictory. For example, the maize CCER concluded that *“important contributions had been made to the livelihoods of the resource poor maize producers and to Africa’s maize industry”* while the EPMR report finds that *“it is obvious (sic) that germplasm improvement and better agronomic practices have not yet reached the resource-poor smallholders”*.

The Center notes that the Panel use the number of papers in peer-reviewed journals as a measure of scientific quality however, would no doubt agree that scientific publications are a single and limited measure of scientific excellence. The Center welcomes the Panel’s endorsement of the success of the Rice Wheat Consortium (RWC), winner of the 2004 King Baudouin Award, and agrees whole-heartedly with the need for donor-commissioned project reviews to become routine input to EPMRs.

#### CHAPTER 4

**General comments:** The Center is concerned that the overall impression in this chapter is one of CIMMYT falling below critical mass in certain areas such as wheat breeding. The Center is firmly of the view that significant gains in plant breeding methodologies in recent years have increased the efficiency of its plant breeding programs and that simple input measures such as staff classified as “plant breeders” do not adequately reflect the genetic progress that is being made in the improvement of wheat and maize. The Center also notes that the CGIAR 2003 annual report highlights that CIMMYT has the largest investment of all centres in one of the five (5) system outputs: *germplasm improvement*.

4. *To facilitate the establishment of a multidisciplinary approach to conducting ex ante impact studies, the Panel recommends that increased integration through time allocation be secured between ITA staff and non-social scientists in the other programmes.*

CIMMYT agrees with the recommendation and notes that a multi-disciplinary approach to research, embracing bio-physical and social scientists, is emphasized in the “Seeds of Innovation” document.

5. *The Panel recommends that ITA, in cooperation with the ecoregional programmes, collect data on the variables that explain the heterogeneity of the existing production functions and thus, of yields (both potential and actual) that express differences attributable to productivity gaps within the same agroecological region, due to constraints that limit the adoption of improved technology.*

CIMMYT agrees with the recommendation and considers this approach to be part of a planned wider research effort to assemble and analyze information on factors determining pathways for technology adoption, livelihood impacts and poverty reduction in major wheat- and maize-based farming systems of developing countries.

6. *The Panel recommends that (the) IITA (Programme) initiate macroeconomic studies by 2006 in close cooperation with IFPRI and other CGIAR Centres. The highest priority should be assigned to sub-Saharan African countries.*

CIMMYT agrees with the recommendation insofar as it refers to analysing sectoral and rural development policy determinants of wheat- and maize-based farming systems improvement and to identify and advocate appropriate policy and institutional responses.

7. *The panel recommends that maize research in CIMMYT identify the high priority Marginal Maize Production Areas (MMPAs) in each mega-environment. Based on such MMPAs, a seed delivery system for improved cultivars should be developed jointly with partners as a vehicle to make CIMMYT's upstream maize research results available to resource-poor farmers.*

**CIMMYT accepts the recommendation to focus on low-yielding areas caused by abiotic, biotic and socioeconomic constraints. CIMMYT has a comparative advantage in the development of germplasm for low to very low yielding environments to which much of our germplasm development efforts in sub-Saharan Africa have been directed. We agree that seed delivery systems require further development and, towards this aim, CIMMYT has recently hired a seed systems specialist for our African Livelihoods Program.**

8. *The panel recommends that maize breeding and research efforts in the following areas be intensified:*
  - a) *Grain quality characteristics of high priority to end users in MMPAs, combined with more systematic research and breeding to reduce mycotoxin contamination on the grain;*

CIMMYT agrees with this recommendation however, notes the need for additional, sustainable resources to ensure that new initiatives have a medium to longer term outlook. In the meantime, CIMMYT will explore opportunities for collaborative work in this area with IITA.

- b) *Testing and evaluation of breeding materials directly in the MMPAs, for identification of the best material for release;*

CIMMYT notes this recommendation and observes that it is routine procedure for experimental materials to be tested in their target environments. CIMMYT has made very significant progress in MMPAs using farmer participatory "Mother-Baby" trials (>1M ha in southern Africa sown with improved maize using this approach) and acknowledges the recommendation as being a strong endorsement of this approach.

- c) *Non-transgenic host plant insect resistance research to speed up the process of integration of the highly resistant CIMMYT germplasm into new varieties;*

CIMMYT notes this recommendation. CIMMYT has invested in host plant resistance work for at least 30 years and considerable progress has been made however, increasingly transgenic approaches to insect resistance are providing significant technical gains. We will continue to work on an integrated pest management strategy that is reflected in a number of ongoing projects.

- d) *Application of fast track breeding techniques (doubled haploid, MAS, NIR techniques) in all maize breeding activities in CIMMYT;*

CIMMYT partially agrees with this recommendation as the value of these technologies should be assessed on a case-by-case basis. CIMMYT has routinely been using MAS for traits where MAS is

more cost-effective than field-based techniques. Recently, CIMMYT has commenced the use of NIR for assessing stover quality in maize and we expect to expand this work. The use of double haploids in maize is a relatively new technique and its utility for marginal and low input environments is yet to be proven. As for our response to 8a) CIMMYT notes the need for additional resources of a medium to longer term nature to implement areas of research of strategic importance.

- e) Acquisition, storage and management of maize breeding data to eliminate the current back-log.*

CIMMYT agrees with this recommendation and notes that decisions have already been made to allocate more resources to the acquisition, storage and management of maize breeding data within CIMMYT during the next two years.

9. *The Panel recommends that:*

- a) Crop management research in (the) TES (Program) in the regions be strengthened by allocating NRM (Crop and Resource Management) staff time from other programmes, particularly IAP, to TES;*

CIMMYT agrees with the recommendation and notes that there are at least two avenues to be pursued: a) additional financial resources are needed for the TES Program; and b) increasing the overall staffing and cross program assignments of Crop and Resource Management scientists generally.

- b) CIMMYT, TES in particular, seek collaboration with other CGIAR Centres in the region, including shared appointments of agronomists and other natural resources specialists;*

CIMMYT agrees in principle with the recommendation. We will follow up on some initial discussions that have already been held with three other centres and also on emerging collaboration among centres within the Water and Food Challenge Program.

- c) The Crop and Resource Management Group, TES and other ecoregional programmes enhance strategic research on natural resource management, particularly for improved water and nutrient use efficiency.*

CIMMYT agrees with the recommendation. Already there is an increased emphasis on more strategic research through two recent appointments and we plan to enhance this approach in future projects

10. *The Panel recommends that the IAP breeding teams work closely with crop management and social science groups to develop cultivars that are suitable for conservation agriculture, use water efficiently and are resistant to storage losses.*

CIMMYT notes the recommendation and observes that activities in the RWC have embraced genotype by management (conservation agriculture) interactions for some time. The plant breeding programs in both maize and wheat, in recent years, have aimed at the development of germplasm with an emphasis on input use efficiency (water) and resistance to storage losses (maize) and the development of materials suited to conservation agriculture. The breeding programs in Mexico run a parallel selection program under conservation agriculture and conventional conditions.

11. The Panel **recommends** that IAP undertake long term experiments to evaluate cropping system sustainability with the results being fully utilized for strategic research as well as for demonstration purposes.

CIMMYT agrees with the recommendation insofar as it relates to long-term trials conducted on CIMMYT's experimental stations in Mexico and notes that trials over the past 10 years in Mexico have provided an excellent platform for strategic research and demonstration. In regional locations, CIMMYT collaborates with research partners to effectively design, manage and utilise long-term crop management trials.

12. The Panel **recommends** that IAP increase its research in maize cropping systems and their development.

CIMMYT agrees with the recommendation and we expect to focus attention on the maize producing regions of Asia where demand is increasing at the fastest rate.

## CHAPTER 5

13. The Panel **recommends** that the data acquisition, data management and genebank user interface be upgraded in the CIMMYT genebank for both wheat and maize as a matter of urgency.

CIMMYT agrees with the recommendation and notes that significant steps are already underway through several different system-wide initiatives to develop a range of integrated modules to fully computerise data acquisition, genebank management, germplasm evaluation and database query across both crops.

## CHAPTER 6

**General comment:** The Center is very pleased to note the Panel's comments at the end of the chapter: "*in terms of developing stress resistant wheat and maize targeted at smallholder producers farming in harsh environments CIMMYT has no peer. In that sense, the quality of science at CIMMYT is outstanding*".

## CHAPTER 7

**General comments:** CIMMYT is pleased that the panel affirms the importance of effective partnerships to the "Seeds of Innovation" strategy and acknowledges the track record CIMMYT has already established in this regard. The Center agrees that the formation of meaningful partnerships and alliances with other CGIAR centers, NARS, NGOs and ARIs will be essential if CIMMYT and other CGIAR centers are to remain relevant to the communities they serve. For this reason, CIMMYT has wholeheartedly embraced the concept of a formal alliance with IRRI and strongly supports the recommendations of the oversight committee convened by the Rockefeller Foundation. However, the Center also shares the view of the panel that there is considerable scope for greater integration of activities with many other CGIAR centers and is committed to ongoing dialogue with the centers mentioned in the report in order to build critical mass, improve efficiencies and enhance the impact of CGIAR activities on the lives of the poor. CIMMYT concurs with the Panel's suggestion that there must be clear definition of those interactions that will be critical to implementation of the "Seeds of Innovation" strategy. The Center fosters excellent relations between individual CIMMYT scientists and scientists from other institutions and there are many examples of highly productive interactions with NARS and NGOs throughout CIMMYT's regional networks.

14. *The Panel recommends that:*

- a) *Training coordinator position be relocated to an independent Unit reporting directly to the DDG-R;*

CIMMYT notes the recommendation. As set forth in the CIMMYT strategy, training and capacity building activities are an integral part of the knowledge management and sharing activities of the ITA Program. These activities are closely related to broader ITA thrusts on the orientation of CIMMYT and its partners to livelihoods and poverty reduction; support to the use of best practices; priority setting and impact assessment; and, advocacy of effective policies to foster impact on the ground.

- b) *The Training Unit working together with programme directors develop a priority setting tool, both thematic and geographical. The resulting priorities should then be used to allocate resource to the programmes;*

CIMMYT agrees in principle with the recommendation for training purposes and plans to implement a priority setting tool as part of the enrichment of the Resource Allocation Tool that was developed during the strategic planning exercise, noting that priorities for capacity building need to be determined within and across programs.

- c) *CIMMYT develop innovative alternative funding schemes for training*

CIMMYT agrees in principle with the recommendation and is actively exploring a variety of options internally and with external stakeholders, including private sector support. Fellowship programs, both internally and externally funded, will be implemented to facilitate capacity building.

## **CHAPTER 8**

**General comments:** The Center is extremely grateful for the thought the EPMP panel has given to this section of the report and Appendix VII. The Board recognises that certain aspects of governance oversight of CIMMYT have failed in the past and has been working with the new management team to improve governance processes.

During its March 2005 meeting, the Board held a one day session to review CIMMYT's governance. A strong consensus was reached on a concept for full and in depth reform of our governance system. This concept will be further developed in the coming months along with a detailed business plan for its implementation after formal approval during the November 2005 Board meeting. Many of the EPMP observations have reinforced our own analysis of the Board's strengths and weaknesses and the recommendations provide a very constructive framework to guide the reform process. At the end of this process we expect that CIMMYT will have a fully revamped governance system of the highest international standards.

In the meantime, we have initiated a number of specific changes in response to the EPMP report with the aim to address the following:

- a) Improved quality of the information provided to the Board.
- b) Agenda setting that is organised to encompass both continuous items of Board work and strategic issues.
- c) Performance evaluation of the Director General that is clearly aligned with CIMMYT's key objectives.
- d) Better use of CCERs as the primary mechanism for science review.
- e) Greater role for the Board in resource mobilization.
- f) Better monitoring of progress on key CIMMYT business issues.
- g) No overlap of trustees on the Audit and Finance and Administration Committees.

Finally, CIMMYT wishes to record that it will continue its dialogue with IRRI and is fully committed to achieving the vision of governance and management recommended by the oversight committee convened by the Rockefeller Foundation.

*15) To help ensure that CIMMYT builds and sustains high functioning Boards, the Panel recommends the establishment of a governance committee with responsibility for a range of activities essential to Board effectiveness, including defining more clearly the role of the board, developing a more strategic process for identifying and recruiting board members, assessing board performance on a formal basis, evaluating the performance of members before re-election, recommending improvements to board practice, such as meeting design and preparation, information flow and communication, and developing an orientation and ongoing education program for members to enhance their performance*

The Board is committed to fulfilling its role to the highest possible standards; with this goal in mind the Board has agreed to further reduce its size to no more than seven appointed members while maintaining the appropriate mix of skills, and to enhance the roles of the Audit and Finance and Administration Committees as agents of the Board. Rather than create a separate governance committee CIMMYT intends to engage a specialist consultant to help the Board and its committees clarify their roles and put in place a more strategic process for identifying and recruiting board members, assessing board performance on a formal basis and evaluating the performance of members before re-election. The consultant will also provide advice on meeting design and preparation, information flow and communication and will work with the Board to develop an orientation and ongoing education program for trustees. It is anticipated that the consultant will also be engaged to review the effectiveness of the Board's processes, in the first instance on an annual basis. In future it is intended that the Board as a whole will explicitly address governance functions in lieu of a governance committee.

*16) The Panel recommends that a dedicated staff person in the DG's office be identified to serve as the Board Secretary. This position should have sufficient status within the organization, clear responsibility and also adequate time to provide support and coordination for the board.*

CIMMYT agrees with the recommendation and has already (effective March 2005) implemented this recommendation.

## **CHAPTER 9**

**General comments:** CIMMYT is pleased that the Panel recognised the role the new Director General has played in leading the institution through an extremely difficult transition which involved painful restructuring and reorientation such that CIMMYT can continue to be relevant in today's environment. The Panel clearly acknowledge the complexity of the change process that is being lead by the Director General and his management team and it is pleasing that the quality of the program directors that will be critical to the future success of CIMMYT's strategy is acknowledged elsewhere in the report. Notwithstanding the commitment of this group, CIMMYT is acutely aware of the poor morale of many CIMMYT staff and in total agreement with the Panel that this needs to be addressed with utmost urgency.

In addition to the specific recommendations made by the Panel we would like to put on record a number of important observations and suggestions that will be acted upon by the Center:

- a) The host country agreement will be reviewed.
- b) Careful attention will be paid to the new matrix management arrangements; effective implementation will be monitored by the Board and, where necessary, management training programs will be put in place.

- c) Professional project and finance management systems will be implemented.
- d) There will be close fiduciary oversight of Generation Challenge Program funding.
- e) A comprehensive business plan to deliver the strategy articulated in "Seeds of Innovation" will be developed for approval at the November 2005 Board meeting.
- f) Corporate services functions will be strengthened.
- g) The human resources function will encompass the support of the Center's human resources strategy.
- h) CIMMYT has agreed, in principle, to implement the One Staff policy.
- i) A new performance management system to support the new organisational structure will be implemented.
- j) New financial oversight measures have been implemented.
- k) CIMMYT will budget annual surpluses of the order of \$2M until 2007 to ensure that working capital of 90-120 days of operations is accumulated.

17) *The Panel recommends that management review the staff survey results in detail with special attention to staff morale, communication of policies, clarity of goals, performance recognition, and staff evaluation, and take appropriate corrective action as a matter of urgency.*

CIMMYT agrees with the recommendation. Clearly, CIMMYT is in a period of transition and it is inevitable that staff morale has been affected over the past two years which have seen down-sizings. CIMMYT will work extremely hard to ensure that all staff have clarity on the future and an important aspect of this will be a new One Staff policy that is already agreed in principle by the Board. Consistent with recommendations 1) and 2) we fully expect that communication of roles and responsibilities to staff, with attendant policies and procedures, will greatly assist staff function and morale.

18) *The Panel recommends that management give priority to reforming financial management at the Centre, including budget, staffing and related systems, with highest priority given to the development of a computerized financial management system that provides real on-time financial information to users; and urgently develop (in consultation with programme staff) a transparent resource allocation process consistent with needs of the matrix management system.*

CIMMYT agrees with the recommendation. We have already commenced the implementation of the following systems which are the initial building blocks for the development of a more comprehensive financial management system:

- An integrated human resource information system (HRIS); the first phase of this project will be implemented by the end of March '05 and the complete staff database will be finalized by the end of June '05.
- CIAT's project manager application. We plan to have an effective project management system in place during the 3<sup>rd</sup> quarter of '05.

The issues surrounding the development and implementation of a completely new financial management information system are being currently reviewed and we are evaluating options of moving to a shared service with another CGIAR Center as a first priority.

19) *The Panel recommends that management carefully examine the correctness of the net assets (equity) balance for 2004 attributable to the increase in 2003 (of approximately US\$ 2.0 million) from fixed assets write-off and revaluation.*

CIMMYT notes this recommendation and has reviewed it with our External Auditors who have confirmed that, while the detail that was presented in the 2003 financial statements was less than

clear, the treatment was correct. The disclosure issue has been clarified in the 2004 financial statements and the relative balances of CIMMYT's net asset categories are correctly stated.

20) *The Panel recommends that the Board and management develop a set of financial indicators for measuring the Centre financial performance and health. The indicators should supplement those developed by the CGIAR System in close consultation with CGIAR Secretariat and Centre Finance Directors.*

CIMMYT agrees with the recommendation. We have discussed and agreed upon a set of financial indicators at the March '05 Board meeting. These indicators are based on those developed by the CGIAR.

21) *The Panel recommends that a full cost recovery/pricing system for support services be implemented to recover the full costs from projects and users of services. This will reduce the pressure on unrestricted funding and make it available for other high priority activities at the Centre, including building the working capital to the required level.*

CIMMYT agrees with the recommendation and has already implemented changes within the '05 budget that will lead to full cost recovery from projects and users of services. It is expected that through a combination of restructuring of our internal costing practices and improved project costing when submitting proposals to donors, we will be able to substantially improve our performance in this area.

22) *The Panel recommends that Board and management:*

- a) Make substantial efforts and allocate adequate time for the careful review of the external audit (at headquarters and regional operations), management letters and the audited financial statements with the notes;*
- b) Carefully review the annual audit plans and scope of external audit for headquarters and regional operations;*
- c) Formally assess annually the performance of the external auditors before deciding on their re-appointment.*

CIMMYT agrees that the external audit function is crucial to the fiduciary oversight of the Center by the Board and asserts that its Audit Committee takes its roles in relation to the External Auditors seriously. The CIMMYT Board Audit Committee and full Board will continue to commit substantial time and effort for the careful review of external audit reports for headquarters and regional offices. The Committee annually receives audit plans, and will review the external audit scope to reflect management's and the Board's assessment of risks, taking into account the changing nature of the Center's programs at headquarters and in the regions. The Audit Committee will develop and implement a formal plan for assessment of the External Auditors prior to renewal or selection of new auditors.

23) *The Panel recommends that Board and management review the scope of internal audit work and the capabilities of the senior internal auditor and make the required changes to strengthen this important function.*

The CIMMYT Board and Management agree that CIMMYT must have a strong internal audit function. The scope and capabilities of the internal audit function will continue to be under review and all necessary and appropriate actions will be taken.

**Conclusion:**

The Center shares the view of the Panel that “the Centre is now poised to move forward into the future”. CIMMYT notes the conclusion of the Panel that “there are still outstanding issues, but for the most part the hard work is behind it” however, we stay firmly committed to the remainder of the task ahead. While we agree with the Panel that “the new strategic plan provides a strong vision for CIMMYT in the future” we share its concerns that more work is needed at the implementation and goal setting levels. The Center in its document “Seeds of Innovation” indicated that it would review the status of implementation of the new strategy in late 2006, a suggestion that dovetails well with the view of the EPMR Panel.

In its concluding comments the panel rightly looks at the CIMMYT of tomorrow. The panel indicates some of the many challenges that still are ahead in a changing world; and draws attention to the key role that CIMMYT has had since its inception of providing public sector improved germplasm. CIMMYT recognizes and restates its clear role in this area. This is one of its enduring strengths as explicitly highlighted in the new strategy. CIMMYT also recognizes the importance of the substantial new investment that is needed by the Center that results from the financial crisis prior to 2002. CIMMYT hopes that donors heed the comment of the Panel that the Center must “seek additional capital support from donors”.

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9 March 2005

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Dear Drs Pinstrup-Andersen and Reifschneider,

I am pleased to transmit to you the Report of the Panel that conducted the Fifth External Programme and Management Review (EPMR) of the International Maize and Wheat Improvement Centre (CIMMYT) headquartered in Mexico. The Panel reviewed, as requested, the research programme and its outputs and impacts, as well as the management and governance, of the Centre.

CIMMYT suffered a severe financial crisis in mid-2002 provoked by the complete rundown of the Centre's capital reserve. A number of factors appear to have contributed to this financial crisis. However, deficiencies in the oversight of the Centre's finances by the Board of Trustees of CIMMYT appear to have been a significant contributing factor. As a consequence, this Panel examined governance issues more closely than EPMRs of other Centres and has made several recommendations for the improvement of the governance of CIMMYT. However, some of the issues facing the CIMMYT Board are common to the boards of other

CGIAR Centres. Therefore in an Appendix to the report, the Panel proposes a more functional and strategic approach to Centre Governance to provoke consideration of the issue across the system.

CIMMYT over the last 18 months has gone through a major transformation. It has a new mission, strategic plan and programme structure. It has a younger staff profile that is better aligned to meet to the needs of its new strategic plan, and the staff have greater skills in a range of modern technologies. CIMMYT also has a new management team in place as well as new scientific leadership. However, the transformation is ongoing-CIMMYT is still a Centre in transition- and the Panel made a number of recommendations to improve both the management of CIMMYT and its scientific programmes. The Panel felt it was too early to judge the effectiveness of the changes that have happened and are continuing to happen at CIMMYT. As a result the Panel has recommended that the CIMMYT Board and management undertake a mid-term review in 2007 to assess the progress towards the full implementation of the new structure and programmes and their effectiveness.

I wish to thank my fellow Panel members who worked together in a common cause with great enthusiasm, commitment and sense of purpose. It was a pleasure to work with them. I also wish to sincerely thank, both personally and on behalf of the Panel, Sirkka Immonen from the iSC Secretariat who served as a resource person and supported the Panel throughout the review. Her assistance was always timely and effective and her exceptional organizational skills ensured the completion of the review as planned. Last, but not least, I thank Selcuk Ozgediz and Manny Lantin from the CGIAR Secretariat who helped from a distance and provided valuable input the governance and management components of the review.

Finally all the Panel Members join me in expressing our appreciation for the opportunity to participate in the challenging task of conducting this Review. We hope our report will be useful to the CGIAR, CIMMYT and its partners.

Yours Sincerely

D.R.Marshall  
Chair, External Review Panel.

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## PREFACE

This is the report of the Fifth External Program and Management Review (EPMR) Panel appointed to evaluate the research program and management of the International Maize and Wheat Improvement Center (CIMMYT). The composition of the Review Panel and short biodata of its members are given in Appendix I. The Terms of Reference for this Review are found in Appendix II. The Guidelines for EPMRs are presented in Appendix III.

The EPMR Panel was guided by the general objectives of EPMRs: (a) providing the CGIAR members with an independent and rigorous assessment of the institutional health and contribution of the Center; and (b) providing the Center and its collaborators with assessment information that complements or validates their own evaluation effort. It reviewed CIMMYT's past performance on the basis of the outputs, outcomes and impact of the program structure as it was until 2004, namely Wheat, Maize, Economics and Natural Resources Programs. It reviewed the performance, institutional health, strategy, vision and potential of the new programs in the light of CIMMYT's role in reaching the poor farming populations who depend on maize and wheat.

The Panel itinerary is provided in Appendix IV. The information, on which the Panel based its decisions regarding the key concerns and issues, and its assessments and conclusions, was gathered in a number of ways. These included:

- numerous documents provided by CIMMYT, the Science Council, and the CGIAR Secretariat, which were made available to the Panel in an EPMR Internet site and are listed in Appendix V;
- additional documentation, including records, plans, data and scientific articles provided to the Panel during the Initial and Main Phases, some of which are referenced in the report;
- documentation gathered and prepared to facilitate the strategic planning process, including compilation of stakeholder perceptions;
- documentation prepared for the CIMMYT Board meeting, observations during the meeting, and interviews of individual Board members;
- group meetings with Program and Management staff during the visits to the Center, including tele- and video-conferences with out-posted staff, followed up by individual meetings with Center staff;
- information from the CIMMYT staff questionnaire survey;
- discussions with CIMMYT stakeholders and staff during visits in Bangladesh and in Mozambique, Zimbabwe and Kenya; and
- additional contacts with sister Centers and key stakeholders within and outside the CGIAR.

The Panel's point of departure was the 4th EPMR of CIMMYT and its key recommendations and analysis. The recommendations, CIMMYT's responses and the Panel's observation on progress are given in Appendix VI.

The Panel made every effort to conduct the review in an open and transparent manner. CIMMYT has a much dispersed staff and during both the Initial and Main Phase even those staff based at the headquarters were travelling or working in Obregon, at CIMMYT research station in Northern Mexico. Video and tele-conferencing was organised to facilitate direct contact with out-posted staff, and the Panel members also followed up through-mail and phone calls. During the Main Phase the Panel Chair held daily briefings with the CIMMYT DG for discussing emerging issues and practical arrangements. Within the limited time available all Panel members interacted with key Management and Program staff to discuss important issues and receive clarification. The draft chapters were shared with CIMMYT management for correction of factual errors.

## EXECUTIVE SUMMARY

### Introduction

This review covers the period since the Fourth EPMR which was initiated in 1997. During this time the Center has seen marked change both internally and in its external environment. Internally, the Center has been through a deep financial crisis which coincided with the appointment of a new DG in 2002, the development of a new mission and strategic plan which led to the implementation of a new research program structure, and a radical shift in its staff profile as a result of staff downsizings and a staff renewal program to better align its staff competencies with the new program structure. It has also been engaged in lengthy discussions with a sister Center, IRRI, about close alliance, possibly merger, and a decision on closer collaboration has been reached.

The changes in the external environment include the “gene revolution” in molecular genetics and genomics, the controversy surrounding the development and release of genetically modified organisms (GMOs), the “IT revolution” in information sciences and bioinformatics, growing private investment in plant breeding of non-hybrid crops, the changing intellectual property environment, the evolution of the CGIAR including the continuing shift in funding from unrestricted to restricted and introduction of Challenge Programs. Clearly, CIMMYT is a Center in transition – reforming and reshaping itself to face a rapidly changing external environment.

Given the dynamic environment in which CIMMYT now operates and the considerable but relatively recent internal change, the Panel conducted Fifth EPMR in two parts. A retrospective part, where we assessed the outputs and impacts of the Center, was based on the old program structure since the new Programs had not been in place long enough to have had an impact in their own right; and a prospective part, based on the new program structure, where we critically examined the appropriateness of CIMMYT today to fulfil its mission into the future. We attempted a comprehensive and rigorous review of CIMMYT’s governance, management and research that included meetings with the Board members, scientists, administrators, a range of stakeholders and site visits to four countries.

### Does CIMMYT have a Future?

The first question the Panel asked was- Are the changes CIMMYT is going through those of a dynamic organization with a clear and unique mission positioning itself to realize that mission, or simply the death throes of an organization that has past its use by date? In short- Does CIMMYT have a future?

The argument against a future role for CIMMYT is simple. CIMMYT’s own analyses indicated that there are more than ample supplies of both wheat and maize in the world to meet current global demand so that prices are at historically low levels in real terms. Further, that for the foreseeable future, growth in supply can more than match growth in demand given the expected improvements in technology generated by the very large investment

(several orders of magnitude greater than CIMMYT's total budget) by both developed and the more rapidly developing countries in wheat and maize breeding and research.

The counterargument is based on the fact that the primary target for CIMMYT's research are the more than 500 million people in the world who are resource poor farmers and their families who live in extreme poverty, grow their own food, and often rely on wheat and maize as their primary source of calories. For these farmers, the global levels of production of wheat and maize, as well as their price, are largely irrelevant. Further, the research outputs targeted at large scale commercial farmers operating in high input production systems in developed, and the more rapidly developing, countries seldom spillover to resource poor farmers in low yielding, low input environments typically subject to multiple biotic and abiotic stresses.

The Panel therefore concluded that the case for the continued support of CIMMYT in developing germplasm with multiple stress resistance specifically targeted at resource poor farmers was strong and clear. Such improved germplasm that was not only accessible to resource poor farmers but specifically targeted to their needs was essential if they were to benefit from the ongoing scientific advances in genetics, genomics, and breeding.

## **Governance**

CIMMYT's Board of Trustees has been one of the more stable components of the Centers organizational structure over the last three years. It is composed of a set of expert, talented and experienced individuals. Yet, collectively the Board, which carries ultimate responsibility for maintaining adequate internal controls, failed in its oversight role of the Center's finances and management. The cost of this failure was borne not by the Board but by the staff and Programs of the Center.

The Board has moved to improve its structure and performance in recent years so that the Governance today at CIMMYT is better than it was in 2001/2. However, it is still not good enough and the Panel identified several areas of the Board's operations that require remedial attention. These include, but are not limited to:

- The size composition and committee structure of the Board
- Board orientation and learning
- Board evaluation of the DG, the Board Chair and itself
- Board oversight of the Centers finances and resource development

A number of the issues identified by the Panel are not unique to the CIMMYT Board but are shared to varying degrees by the Boards of all the CGIAR Centers. In an Appendix to this report the Panel proposes a more functional and strategic approach to Center Governance as a means of heightening awareness of the issues across the CGIAR and perhaps invoking a coordinated system wide approach to their resolution.

## **Management**

The present DG of CIMMYT, faced with an extremely difficult financial and management situation when he arrived in mid-2002, has moved decisively to stabilize the finances of the

Center, streamline the management structure, and strengthen the control and monitoring mechanisms of the Centers operations. However, while much has been achieved in improving the management of CIMMYT over the last two years, there are areas where significant problems still exist which will require remedial action by the management in the near term.

Several of these problems are not new. For example, the problems identified by this review, including the lack of an effective computerized financial management system, a functioning project management system and the lack of a full cost recovery/pricing system for support services, were all issues identified in the last EPMP. Nothing was done to resolve these issues in the intervening 7 years, which makes their resolution now more pressing. The Panel has also suggested that steps be taken to improve the internal and external audit functions at the Center (Chapter 9).

The Panel surveyed both IRS and NRS staff as part of the review process. The survey indicated there was a significant problem with staff morale in the Center, which is perhaps not surprising given the recent financial problems and staff downsizings, but it was also clear that staff were unhappy with several aspects of CIMMYT's HR policies and processes. The Panel feels these problems require urgent corrective action to ensure CIMMYT can continue to attract and retain good staff.

### **Strategic Planning**

In 2002 the CIMMYT Board and new DG initiated a wide ranging and comprehensive planning process which resulted in a new mission, organizational structure, and strategic plan for the Center. The planning process itself was excellent – thorough, inclusive of CIMMYT stakeholders, systematic and well documented. The new mission, while ambitious, is in line with the CGIAR goals of alleviating poverty, increasing food security and improving sustainability. The new strategic plan provides a strong vision for CIMMYT in the future where priority will be given to a holistic approach to understanding livelihood systems, impact –oriented Programs that will catalyze interdisciplinary research, decentralization of Programs away from Mexico, and partnerships that can leverage capacity and help accelerate results. It also describes a new program structure for the Center which is a matrix of 2 global and 4 ecoregional interdisciplinary Research Programs and 5 disciplinary Groups (Chapter 2).

However, the new strategic plan also suffers from some significant deficiencies. Perhaps the most important was the absence of clearly defined goals, the heart of an effective strategic plan that would drive priority setting and resource mobilization and allocation. It also lacked a clear definition of the areas of wheat and maize research targeted at reducing poverty where CIMMYT had a strong comparative advantage, another key to effective priority setting. The Panel included in its recommendations that these deficiencies be rectified and that senior management, as well as the 6 new Program Directors who are all now in place, develop specific goals for the strategy as well as a business strategic plan and operational plans to facilitate the successful implementation of the new strategy in a dynamic and challenging environment that CIMMYT finds itself.

## **Accomplishments and Impact**

Despite the ongoing funding crisis at CIMMYT for much of the review period and the turmoil it invariably created, the Panel was very pleased to find that CIMMYT's scientific staff continued to produce a range of outstanding outputs. In the case of wheat, these include high yielding bread wheat lines in a range of maturity classes with durable rust resistance and improved adaptation to drought stressed environments. In the case of maize, a major output has also been improved germplasm with specific traits including enhanced drought tolerance, herbicide resistance to facilitate Striga control, and Quality Protein Maize. In the case of Natural Resource Management, the outputs include the development of conservation agriculture practices –zero tillage, crop rotations and raised beds that reduce soil degradation and water use and increase production.

CIMMYT also produced strong evidence of the impact of its work. A formal study of the value of durable multigenic resistance to leaf rust in developing country agriculture estimated the net present value of the research since its inception was US\$ 5.36 billion and the benefit: cost ratio was 27:1. CIMMYT's scientists received the World Food Prize in 2002 for work in the development of Quality Protein Maize (QPM) which is now being grown on nearly one million hectares worldwide. Zero-till and raised beds are also being widely adopted in a range of cropping systems in developing countries, particularly in Asia.

The Panel feels that CIMMYT should be congratulated for its continuing strong practical outputs from its science that continue to have a strong positive impact on the livelihoods of resource poor farmers.

## **Quality and Relevance of Science**

The Panel examined a number of components of the quality of science and relevance of science at CIMMYT.

Science relevance is primarily determined by the quality and effectiveness of the strategic planning, priority setting and resource allocation processes put in place by the Center. Judging by the outstanding impacts of CIMMYT's research, there is no question as to the relevance of past research programs. Due to the lack of a fully articulated strategic plan, with clear goals and priorities, the Panel found it difficult to judge the relevance of CIMMYT's research going forward.

Staff quality, research infrastructure and quality assurance processes are all important in determining the quality of science. Staff quality at CIMMYT was good to very good. The Panel was favourably impressed by the uniformly high quality of the newly appointed directors of CIMMYT's new Research Programs. However, the research infrastructure at CIMMYT is highly variable and has been often been neglected during the ongoing financial crisis. Considerable investment will be required to bring it up to the level expected of an international research institute in a number of areas (Chapters 5 and 6).

The internal and external quality assurance procedures at CIMMYT appear to be operating well except in two areas. One is the evaluation of staff performance which the staff, but

perhaps not management, thought was inadequate. The other was the very limited use by the Center of CCER's to monitor the quality of science of its Programs.

In an attempt to assess the overall quality of science in the Center, the Panel compared the record of publications in refereed international journals of CIMMYT scientists against the record of scientists in IRRI. Overall IRRI staff published more papers than CIMMYT staff, with a greater proportion of staff at CIMMYT producing less than one paper per year than the staff at IRRI. While publications in refereed journals are only one indicator of science quality, it is widely used internationally, and would be a useful way for CIMMYT to show improvement in the future.

### **Implementation of the New Program Structure**

CIMMYT is in the process of implementing its new program structure based on a matrix of 2 global and 4 ecoregional Research Programs, which deliver outputs and impacts, and 5 Disciplinary Groups, which ensure continuing scientific excellence. While major steps have been taken by CIMMYT in implementing its new program structure, there are still outstanding issues which if left unresolved may cause significant problems in the future.

Matrix management systems are complex and can be difficult to effectively implement. They require scientists to manage staff, resources and relationships, skills they may not have developed to the level required. The Panel felt that CIMMYT was underestimating the difficulty in implementing its new matrix management system and needed to put in place detailed implementation plans to make it operational including:

- Definition of the responsibilities and authorities of Program Directors and Disciplinary Group Leaders
- Development of operating procedures for all staff with roles and responsibilities
- Provision of leadership and management training for senior scientific and management staff
- Streamlining and revision of the support systems and processes of the Center

The Panel also critically examined the progress towards the implementation of the MTP projects for each Research Program (Chapter 4). While the Panel raised specific issues in relation to a number of the Programs it was clear that it was not yet possible to critically assess the capacity of the new Programs to deliver their planned outputs and impacts. The Panel therefore strongly recommends that the CIMMYT Board and management undertake a mid-term review in 2007 to assess progress towards the full implementation of the new structure and Programs.

### **Conclusions**

CIMMYT is clearly a Center in transition. It has to a degree stabilized its financial situation and put in place a plan to rebuild its financial reserves. It has developed a new Mission, Strategic Plan, and Program structure through a comprehensive and inclusive consultation process and is well down the road in implementing change. It has put a new management team in place and gone through a significant staff renewal process. The Center is now poised

to move forward into the future. There are still outstanding issues as always but for the most part the hard work is behind it.

The Panel is convinced that a compelling case exists for the continuation of CIMMYT to develop germplasm resistant to multiple biotic and abiotic stresses and designed to meet the needs of resource poor farmers, dependent on wheat or maize, living in harsh environments. To a great degree these are the forgotten people; the advances in agricultural research and development over the last fifty years have largely passed them by, and the varieties they grow and their yields have often been static for decades. For the first time, the combination of a well characterized collection of genetic resources and modern genetic technologies make the development of improved germplasm with significantly increased yields for such difficult environments an achievable goal. CIMMYT is uniquely placed to achieve this goal.

## RECOMMENDATIONS

### 2 – CIMMYT's New Strategy

1. The Panel recommends that senior Management and Program Directors undertake a much more rigorous process to define goals for the new strategy that provide a framework within which to organize projects and activities and against which progress in meeting the goals can be measured. In addition to strengthening the implementation of the new strategy, the process will enable the Program Directors as a team to identify a set of goals that are congruent across the Center.
2. The Panel recommends that CIMMYT develop a business strategic plan that will support the successful implementation of the new strategy in the face of a dynamic financial environment.
3. The Panel recommends that CIMMYT Management and Board undertake a mid-term review in 2007 focused on the implementation of the new strategy, the efficacy of CIMMYT's reorganization and the impact of financial capacity on CIMMYT's Programs and operations.

### 4 – The New Research Program

4. To facilitate the establishment of a multidisciplinary approach to conducting ex ante impact studies, the Panel recommends that increased integration through time allocation be secured between ITA staff and non-social scientists in the other Programs.
5. The Panel recommends that ITA, in cooperation with the ecoregional Programs, collect data on the variables that explain the heterogeneity of the existing production functions and thus, of yields (both potential and actual) that express differences attributable to productivity gaps within the same agroecological region, due to constraints that limit the adoption of improved technology.
6. The Panel recommends that ITA initiate macroeconomic studies by 2006 in close cooperation with IFPRI and other CGIAR Centers. The highest priority should be assigned to sub-Saharan African countries.
7. The Panel recommends that maize research in CIMMYT identify the high priority Marginal Maize Production Areas (MMPAs) in each mega-environment. Based on such MMPAs, a seed delivery system for improved cultivars should be developed jointly with partners as a vehicle to make CIMMYT's upstream maize research results available to resource-poor farmers.
8. The Panel recommends that maize breeding and research efforts in the following areas be intensified:
  - Grain quality characteristics of high priority to end users in MMPAs, combined with more systematic research and breeding to reduce mycotoxin contamination on the grain;

- Testing and evaluation of breeding materials directly in the MMPAs, for identification of the best material for release;
- Non-transgenic host plant insect resistance research to speed up the process of integration of the highly resistant CIMMYT germplasm into new varieties;
- Application of fast track breeding techniques (doubled haploid, MAS, NIR techniques) in all maize breeding activities in CIMMYT;
- Acquisition, storage and management of maize breeding data to eliminate the current back-log.

9. The Panel recommends that:

- Crop management research in TES in the regions be strengthened by allocating NRM staff time from other Programs, particularly IAP, to TES;
- CIMMYT, TES in particular, seek collaboration with other CGIAR Centers in the region, including shared appointments of agronomists and other natural resources specialists;
- The Crop and Resource Management Group, TES and other ecoregional Programs enhance strategic research on natural resource management, particularly for improved water and nutrient use efficiency.

10. The Panel recommends that the IAP breeding teams work closely with crop management and social science groups to develop cultivars that are suitable for conservation agriculture, use water efficiently and are resistant to storage losses.

11. The Panel recommends that IAP undertake long term experiments to evaluate cropping system sustainability with the results being fully utilized for strategic research as well as for demonstration purposes.

12. The Panel recommends that IAP increase its research in maize cropping systems and their development.

## **5 – Research Support**

13. The Panel recommends that the data acquisition, data management and genebank user interface be upgraded in the CIMMYT genebank for both wheat and maize as a matter of urgency.

## **7 – Partnerships and linkages**

14. The Panel recommends that:

- Training coordinator position be relocated to an independent Unit reporting directly to the DDG-R;
- The Training Unit working together with Program Directors develop a priority setting tool, both thematic and geographical. The resulting priorities should then be used to allocate resource to the Programs;
- CIMMYT develop innovative alternative funding schemes for training.

## **8 - Governance**

15. To help ensure that CIMMYT builds and sustains high functioning Boards, the Panel recommends the establishment of a governance committee with responsibility for a range of activities essential to Board effectiveness, including defining more clearly the role of the board, developing a more strategic process for identifying and recruiting board members, assessing board performance on a formal basis, evaluating the performance of members before re-election, recommending improvements to Board practice, such as meeting design and preparation, information flow and communication, and developing an orientation and ongoing education program for members to enhance their performance.

16. The Panel recommends that a dedicated staff person in the DG's office be identified to serve as the Board Secretary. This position should have sufficient status within the organization, clear responsibility and also adequate time to provide support and coordination for the board.

## **9 – Management and Finance**

17. The Panel recommends that Management review the staff survey results in detail with special attention to staff morale, communication of policies, clarity of goals, performance recognition, and staff evaluation, and take appropriate corrective action as a matter of urgency.

18. The Panel recommends that Management give priority to reforming financial management at the Center, including budget, staffing and related systems, with highest priority given to the development of a computerized financial management system that provides real on-time financial information to users; and urgently develop (in consultation with Program staff) a transparent resource allocation process consistent with needs of the matrix management system.

19. The Panel recommends that Board and Management carefully review the adequacy of the level of net assets (equity) balance for 2004 which was increased in 2003 by approximately US\$ 2.0 Million from fixed assets write-off and revaluation.

20. The Panel recommends that the Board and Management develop a set of financial indicators for measuring the Center financial performance and health. The indicators should supplement those developed by the CGIAR System in close consultation with CGIAR Secretariat and Center Finance Directors.

21. The Panel recommends that a full cost recovery/pricing system for support services be implemented to recover the full costs from projects and users of services. This will reduce the pressure on unrestricted funding and make it available for other high priority activities at the Center, including building the working capital to the required level.

22. The Panel recommends that Board and Management:
- Make substantial efforts and allocate adequate time for the careful review of the external audit (at headquarters and regional operations), management letters and the audited financial statements with the notes;
  - Carefully review the annual audit plans and scope of external audit for headquarters and regional operations;
  - Formally assess annually the performance of the external auditors before deciding on their re-appointment.
23. The Panel recommends that Board and Management review the scope of internal audit work and the capabilities of the senior internal auditor and make the required changes to strengthen this important function.

# 1 BACKGROUND AND CONTEXT

## 1.1 CIMMYT in a Changing World

CIMMYT was one of the four original Centers established by the CGIAR in 1966 with global responsibility for wheat and maize. As a result of its early successes and impact in wheat and more recently, in both wheat and maize, CIMMYT has long been seen as a flagship institution in the CGIAR. More than three quarters and about one third of the developing world's total wheat and maize area cultivate varieties with some CIMMYT germplasm generating some US\$ 3 billion in extra grain per year.

CIMMYT has also been a remarkably stable institution. Until recently, both its staffing profile and the structure of its Research Programs had undergone only relatively modest incremental changes over the years. However, CIMMYT is now experiencing a period of profound change which is impacting all aspects of CIMMYT operations. These changes are being driven by the Board and Management to meet the extraordinary and ongoing changes in CIMMYT's external environment, to better meet the needs of its stakeholders and partners, and to modernize the operations of the Center in line with international best practice.

In 2002, as part of this process of change, CIMMYT's Board of Trustees initiated a comprehensive strategic planning exercise involving input from Board members, Management, staff and a wide spectrum of external stakeholders and partners. Using this input the Center developed a new mission and strategic plan (CIMMYT, 2004) which called for a radical reorganization of CIMMYT's Research Program. At the time of this EPMP, CIMMYT had taken significant steps in the implementation of its new program structure and strategy, which has involved marked changes in the staffing profile of the Center and in the responsibilities of many staff. While much has been achieved, it is also clear much remains to be done.

Because of this the timing of the EPMP has been raised as an issue. It has been suggested that, given the many and significant changes to the program, structure and staff of CIMMYT called for under the new strategic plan, the EPMP should have been delayed and that more time should have been allowed for the Center to implement its plan. However, the arguments against further delay were threefold. First, the last EPMP was initiated eight years ago in 1997, a period that already substantially exceeds the normal interval between reviews of CGIAR Centers. Second, a major purpose of the EPMP is to assess the outputs and impacts of CIMMYT's research and these are likely to be only marginally affected by recent staff and structural changes. Finally, it was felt that the structural and programmatic changes now being implemented at CIMMYT will need to be in place for several years before their impact can be fully and objectively evaluated.

In terms of the conduct of the EPMP, the fact that the programmatic and structural changes were still being implemented at the time of the review meant that the retrospective assessment was done on the basis of the old program and structures, while the forward looking or prospective aspects, which constitute a major part of the review, were based on the new structure and programs.

## **1.2 Drivers of Change**

Over recent years CIMMYT has been confronted with an unprecedented suite of interacting changes in its operating environment, which are important in assessing CIMMYT's new strategic direction. Several of the more important drivers of change are considered below.

### **1.2.1 Level and Type of Financial Support**

In 2002 CIMMYT experienced a significant financial crisis. This crisis was triggered by the fact that between 1997 and 2002 CIMMYT maintained an overly ambitious program of research that eroded the working capital reserve from more than US\$ 9 million to just US\$ 0.2 million (the equivalent of two days of working capital). It was exacerbated by a number of other factors including: (i) a decrease in the proportion of unrestricted core funding to the Center from 55% in 1997 to 36% in 2005; (ii) moves to tap non-traditional funding sources which proved to be unreliable or ephemeral; and (iii) increased standard of living in Mexico and a significant revaluation of the Mexican peso against the US dollar which have dramatically increased labour costs in the host country. The situation was also exacerbated by inadequate financial management systems within the Center.

This financial crisis led to several rounds of staff reductions over 2002-2004. In 2005 CIMMYT has a projected budget of US\$ 37.46 million of which US\$ 13.49 million is unrestricted and US\$ 23.97 million restricted or special project funding. It employs 101 Internationally Recruited Staff (IRS) and postdoctoral fellows - down from 120 in 1997. It also has a total of 647 Nationally Recruited Staff (NRS).

### **1.2.2 Changes in the CGIAR**

During the last seven years the CGIAR has itself gone through a process of review and renewal. The CGIAR adopted a new vision, mission and strategy in 2000 which stressed sustainable food security and poverty reduction in developing countries through scientific research and research related activities. The new strategy was based on 7 planks: (i) Focus on people and poverty reduction; (ii) Utilization of modern science to bear on difficult to address causes of poverty; (iii) Identification of sub-Saharan Africa (SSA) and South Asia as regions of highest priority; (iv) Adoption of a regional approach to research; (v) Emphasis on partnerships to improve efficiency and effectiveness in achieving poverty reduction and food security; (vi) Utilization of a task force approach to improve impact across the CGIAR System; and (vii) Strengthening the role of the CGIAR as a catalyst, integrator and disseminator of knowledge.

In 2001 the System implemented a major program of reform based on 'four pillars of change:

- Adoption of a programmatic approach to CGIAR research and endorsement of Challenge Programs (CP)
- Approval of an annual general meeting and creation of an Executive Council (ExCo)
- Transformation of the Technical Advisory Committee (TAC) into a Science Council
- Creation of a Systems Office to support the work of all parts of the System

With the four 'pillars of change' in place the CGIAR is now giving priority to reforms in the Centers and in particular, on programmatic and structural alignments of the Centers in focusing on regional and global problems. This prompted the Center Directors Committee to

examine ways of facilitating greater co-operation and collective action amongst the Centers at a retreat in Addis Ababa in July 2004. A key recommendation of the retreat was the formal establishment of a Future Harvest Alliance with the CDC acting as the Executive of the Alliance and the Committee of Board Chairs as the Alliance Board. Another key recommendation was the establishment of set of ten 'guiding principles' to facilitate future collective actions.

However, despite all the changes that have occurred, there are still significant unresolved issues and tensions in the CGIAR that seriously impact on the operation of individual Centers. One of these has been the rapid erosion of core support for the Centers by donor agencies over the 1990s and its only partial replacement by special project funding. This trend has been exacerbated by the development of the CPs and by the reluctance of some donors who do provide unrestricted core funds to fund the overhead costs of special projects. A second has been the strong push in recent years for collective action by the Centers while emphasizing, through actions such as linking part of the World Bank contribution to Centers to the level of funds raised, their need to compete.

### **1.2.3 Rapid Advances in Molecular Genetics and Genomics**

The last decade has seen rapid advances in the science underpinning plant improvement, especially in the areas of molecular genetics and genomics, and the rate of change is expected to accelerate rapidly over the coming decade. These advances are being driven by strong investments by private companies and by governments not only in developed countries, but in some of the larger and more rapidly developing countries, through Universities or public research institutes. Further the scale of investments dwarfs that of the CGIAR as a whole, let alone individual Centers such as CIMMYT.

To date much of the pioneering work in the genomics of cereals has been in rice because of its smaller genome, however, increasing investment is now being made in maize and wheat. Further, synteny of the grass genomes will allow the rapid use of molecular genetic information across all species. The implications going forward for CIMMYT are severalfold.

First, the advances in genomics at the more applied end are likely to flow quickly through to crop improvement programs making greater investment by CIMMYT in areas such as marker assisted selection (MAS), molecular fingerprinting of genebank accessions, transformation technology and gene and trait mapping, a critical priority if CIMMYT is to maintain modern and competitive programs and assist developing country NARS to access and use these technologies.

Second, with respect to gene discovery and more upstream research, CIMMYT is likely to be a very minor player amongst a large field of alternate suppliers in developed countries, especially in maize but increasingly in wheat. Therefore it will need to concentrate its limited resources in those areas that are of priority interest to smallholder farmers and where CIMMYT has a competitive advantage. As a consequence, CIMMYT will need access to the advances made by others to ensure its wheat and maize improvement programs remain competitive and it will need to develop the relationships and mechanisms that facilitate this access.

Third, one of CIMMYT's strong advantages at this time is the maize and wheat genetic resources it holds in trust as these can now be mined much more rapidly than in the past. However, even here there are numerous alternative suppliers, and with synteny, unless CIMMYT moves to make its collections a key asset in the global research effort, it will quickly be replaced by alternatives.

#### **1.2.4 Information Technology**

Information technology (IT) has also advanced rapidly over the last two decades so that the collection, storage and manipulation of very large data sets are now potentially routine. The capacity to acquire, store and manipulate large bodies of data is critical to cutting edge research in areas such as plant breeding, genetic resources, genomics and geographic information systems (GIS). Hence if CIMMYT is to remain competitive in research in these areas it will need to have up to date capacity in IT.

#### **1.2.5 Intellectual Property Rights**

Intellectual Property Rights (IPR) have emerged as a major issue for the CGIAR Centers, particularly over the last decade. Several factors have contributed to the growing importance and complexity of IPR for the Centers. First, with respect to genetic resources, the Convention on Biological Diversity, which came into effect in 1998, declared that nations have sovereignty over the genetic resources in their territory and required those who wish to collect genetic resources to enter into formal agreements with the appropriate government authorities regarding what can be collected and the future disposition of these materials. This was followed by the International Treaty on Plant Genetic Resources for Food and Agriculture (International Treaty on PGRFA) which came into force in 2004, which establishes a multilateral system for the exchange of germplasm for the major food crops including wheat and maize under agreed terms, including a standardized Material Transfer Agreement. The International Treaty on PGRFA obliges CIMMYT, if it enters into agreement with the Governing Body of the Treaty, to provide the materials held in its genebank on trust to member countries under the terms of the Treaty but also guarantees the member states will make materials they own available to CIMMYT under the same terms. The Treaty therefore provides a strong legal framework for germplasm exchange within which CIMMYT and a wide spectrum of its partners can operate with confidence into the future.

Second, with respect to patents, the 1994 Agreement on Trade Related Aspects of Intellectual Property (TRIPS) imposed on all member states the obligation to provide at least minimum levels of IPR protection including IPR protection for plant varieties, either through patents or an effective *sui generis* system or both, and biotechnological innovations. The growth in private investment in the biosciences and plant breeding has been matched by the growth in the use of patents to protect innovations so they can be commercially exploited by their owners. As a result of the TRIPS agreements, patent applicants are increasingly seeking protection in developing countries. In addition many public institutions including universities in developed and developing countries are seeking IPR protection for their innovations if this is financially advantageous. Hence, while IPR issues are already a matter of concern for CIMMYT and the CGIAR they are likely to increase rapidly in importance in the coming years. The Center as well as the CGIAR System needs to work with developing country institutions to explore new ways of making the technologies poor farmers need available to them.

### **1.2.6 Private Investment in Plant Breeding**

Private companies have long dominated the commercial breeding sector in crops such as maize, sorghum and sunflowers where hybrid technologies, which force farmers to purchase new seed each year and allow companies to profit from their investment in cultivar development, were readily available. In contrast, up until relatively recently the breeding of non-hybrid crop cultivars was, with some minor exceptions, undertaken by the public sector. However, the use of intellectual property protection either in the form of plant breeders' rights or patents and coupled with seed or end-point royalties, have opened the way for profitable private investment in the commercial breeding of non-hybrid varieties of crops such as wheat, barley and rice where farmers have traditionally saved their own seed. Consequently, privatization of the breeding of crops that were once exclusively in the public domain is expanding rapidly not only in developed countries but also in a number of the stronger developing countries.

The investment by private companies is also motivated by recognition of the fact that ultimately the only way for private capital to profit from investments in agricultural biotechnology and genomics is through seed sales to farmers. Unless the products developed by these new technologies find their way into farmers fields they will not be profitable, and the only way to do this generally is through improved seeds.

With the growth in private investment, public investment is likely to rapidly diminish. Governments in particular invested in the breeding of crops such as wheat because of market failure. If that market no longer fails and is being met by strong private investment, then governments are likely to withdraw. Of course, private companies will not invest in variety development for more marginal areas where profits are difficult to generate. The trend towards the replacement of government support by private investment in the breeding of non-hybrid crops has important implications for CIMMYT. In particular, in countries and regions that can support a strong seed industry, corporate rather than public breeding programs are likely to become increasingly important as partners and users of CIMMYT's improved germplasm over the coming decade. In contrast, in marginal areas which cannot support a viable commercial seed industry, government programs are likely to be replaced by NGOs.

## **1.3 Wheat and Maize Production**

### **1.3.1 Global Overview**

Wheat is the primary grain consumed by people around the world. About 75% of the world's wheat is consumed directly, 15% is consumed indirectly as animal products, and another 10% is used for seed and industrial use. The global consumption of wheat doubled in the last thirty years to more than 600 million tons per year in recent years. Global production has matched global consumption over that period principally due to increased yield per ha and, as a result, global prices have declined over many years, with a few minor exceptions, and are now at historic lows in real terms. Wheat continues to be the most highly traded food grain averaging about 105 million tons over the last decade or about 20% of world wheat production.

Wheat consumption is expected to continue to grow over the next 20 years, perhaps a little more slowly than it has in the last decade, due to increased population growth, increasing urbanization and its associated changes in dietary patterns, and increasing incomes. This future growth in wheat consumption is expected to originate in developing countries where population is growing at about 1.5% per year compared to about zero growth on average in developed countries. In addition urbanization is a phenomenon that is largely confined to the developing world. Wheat production is expected to match the rise in consumption over the next 20 years due to further technological based improvements in yield per ha or increased area of production.

Maize consumption has also more than doubled over the last thirty years to about 590 million tons per year. In the case of maize about 66% of production of mainly yellow maize goes to feed while 17% of mainly white maize goes to food. The remaining 17 per cent goes to industrial uses and seed. Global production of maize has also kept pace with consumption for many years keeping downward pressure on prices, so that like wheat, maize prices are at historical lows in real terms. Maize is the most highly traded feed grain with about 77 million tons or about 13% going into international trade in recent years.

Maize consumption is projected to expand at roughly the same rate as it has in recent years. The composition of the demand is expected to change with feed use increasing more rapidly than food use in both developed and developing countries. Hence the market for yellow maize will increase relative to the market for white maize. However, the market for white maize is likely to remain strong in Mexico, Central America, and eastern and southern Africa. At a global level maize production is likely to match global demand for the foreseeable future since most of the major producing countries have considerable capacity to expand production in response to increased demand.

### **1.3.2 Developing Country Overview**

While the global outlook for wheat and maize is one of ample supply, both now and in the foreseeable future, and stable or decreasing real prices, the outlook for developing countries, especially the slower developing countries is far less optimistic. Maize and wheat occupy just over 190 million ha in developing countries and together account for more than 40% of the crop calories consumed in those countries. Developing countries use more than 50% of both maize and wheat but produce only about 45% of the total production of each crop. Use of these crops in developing countries is expected to increase to close to 65% of total world production by 2020, while production is expected to increase to only 50% of the total. Today wheat and maize represent a significant proportion of developing country food imports (43 and 28% respectively) and this is expected to grow, especially in Central and West Asia and North Africa (CWANA), East Asia and SSA, as the deficit in developing country production versus utilization increases.

## **1.4 Is There a Future for CIMMYT?**

CIMMYT has been highly successful since its establishment principally because of the global impact of its germplasm development activities initially in wheat, and more recently, in both wheat and maize. While CIMMYT has produced a range of other outputs that complement its improved germplasm, and enhance their impact on poverty reduction, germplasm development has remained the core of its activities since its inception. However, the increasing privatization of plant breeding, the enormous investment in biotechnology and breeding not only by private companies but by governments and public institutions in the developed and the larger developing countries, as well as the ample current and continuing global supply of wheat and maize, has raised the question of whether CIMMYT as it stands today has a role to play in the medium to longer term. Do the radical changes being implemented reflect a leaner, better targeted organization that can significantly reduce poverty in the future or do they merely represent the death throes of an organization that has a limited short term future? The Review Panel considered this issue in two parts: (i) whether a case could be made for continuing investment in a Center that produces improved wheat and maize germplasm targeted at poor farmers as an international public good; and (ii) whether the current institutional arrangements for CIMMYT were optimal for it to carry out such a task if it were justified. Each of these issues is discussed below.

### **1.4.1 Case for Germplasm Development of Wheat and Maize**

The Review Panel concluded that the case for a continued strong focus by the CIMMYT on germplasm development was clear. More than one billion people in the world live in extreme poverty (defined as earning less than US\$ 1/day), concentrated in East Asia, South Asia and SSA. Of these, more than 70% live in rural areas, and about 500 million are smallholder farmers and their families. These farming families are largely dependent on the food they produce themselves from wheat (South Asia), maize (SSA) and rice (East Asia) based farming systems. The most important initial step in escaping from rural poverty in most low-income countries is raising the output of the smallholder farmers through improved production systems, of which improved cultivars are a critical element. More importantly, the benefits of research in many areas such as genetic resources, wide crosses, biotechnology, genomics and durable disease resistance, can only be delivered to farmers through improved germplasm and commercial cultivars.

In the past CIMMYT has focused much of its research effort on the large number of the worlds poor who live in densely populated rural areas where cropping systems are often irrigated, intensive, complex and potentially highly productive. The reasons for this were both the scale of these systems and the potential for research to achieve significant impact. While the impact of CIMMYT and others in these areas has been substantial, there is a strong continuing need for maintenance breeding and further research to maintain the sustainability of these areas. More recently the Center has broadened its focus to include smallholder farmers in poorly productive environments, which are usually rainfed and suffer from multiple biotic and abiotic stresses, and where past efforts to improve productivity and livelihoods have had very limited impacts. However, regardless of the environments in which these farmers farm, it is absolutely clear that without improved cultivars in their fields, which meet their specific needs, smallholder farmers will become mere bystanders to the worldwide revolution in molecular genetics and genomics, and the

use of these tools in the innovative mining of the *ex situ* genetic resource collections of crops such as wheat and maize for useful genes.

While the need for improved germplasm is clear, does CIMMYT need to play a continuing role in germplasm development targeted specifically at small stakeholders? There has been enormous public and private investment in biotechnology and the improvement of the major cereal crops, including wheat and maize, in developed countries as well as the stronger and faster growing developing countries. The level of external investment in these areas dwarfs that in the CGIAR Centers individually and as a whole. However, the prime focus of this external global investment is on large scale commercial farmers operating in sophisticated high input production systems. It is not aimed at developing germplasm for poor smallholder farmers and especially those in low yielding, low input environments.

While there may be spillovers from research in developed countries to developing countries it is likely to be limited to large commercial farms. Experience over the last thirty years has demonstrated unequivocally that smallholder farmers enjoy very limited spillover benefits from breeding and biotechnology research in developed countries. For example, the intensive research in maize breeding and biotechnology in the USA and Europe over this period has had no real direct impact on the smallholder farmers in SSA. The Review Panel therefore concluded that an organization such as CIMMYT which produced international public goods that were not only accessible to smallholder farmers, but tailored to their needs, was critical if smallholder farmers were to benefit from the ongoing scientific advances in genetics, genomics and breeding.

The Panel recognizes that germplasm development alone will not necessarily raise the productivity for smallholder farmers in maize and wheat based farming systems in difficult environments. Rather, it is a primary element that in combination with improved crop management practices, and changes in other factors including agricultural policy variables, can significantly boost productivity. The Panel also recognized that raising productivity is also only a first step in raising most smallholder farmer households out of poverty. New income generating enterprises, both on and off farm, will have to enter into their livelihood strategies.

Nevertheless, it is CIMMYT's collection of maize and wheat genetic resources, expertise and effectiveness in plant breeding for low input, high stress environments, and capacity to act as a bridge to ensure the benefits of the advances in molecular genetics and genomics reach smallholder farmers, which are its unique strengths.

#### **1.4.2 Institutional Arrangements**

Since its establishment CIMMYT has had the global mandate within the CGIAR for research on wheat and maize. However, research on the two crops was run in parallel Programs within the same institution, with only limited interaction between the Wheat and Maize Programs. This separation extended to basic functions such as the conservation of the genetic resources of wheat and maize held in trust by CIMMYT, where it would be expected that a joint gene bank program would have generated significant efficiencies. Because of this, it was often suggested that the two Programs should be placed in separate institutes with the

Wheat Program remaining in Mexico or perhaps transferred to ICARDA with a focus on the CWANA region and, and the Maize Program moved to a separate institute in Africa.

More recently, following the decision of the CGIAR to adopt an evolutionary approach to restructuring the Centers and more particularly with the emphasis on reducing competition between Centers and facilitating greater interaction in achieving global goals, the focus has been more on amalgamation than fragmentation. In particular, the merging of CIMMYT and IRRI, among others, to create a new more powerful International Crop Research Center has been widely canvassed. The questions here are: Should CIMMYT be retained in its present form? Or alternatively, should it be amalgamated with another institution in whole or should parts be amalgamated with several institutions?

To its credit the CIMMYT Board during its comprehensive strategic planning process examined the question of its future as an autonomous entity. The Board decided that of the range of possible options available they would more formally explore the potential for closer alliance between CIMMYT and IRRI through discussion between the Board Chairs. Following these discussions the Boards of the two Centers agreed to explore the alternatives for a close collaboration ranging from a formal alliance to a full merger. The rationale was the anticipated gains in international agricultural research and development, especially in areas such as genetic resources, genomics, IT, and GIS among others. They established an IRRI-CIMMYT Alliance Working Group of five independent members, hosted by the Rockefeller Foundation, to formally assess the options of a closer functional alliance of IRRI and CIMMYT. The Working Group in turn established an Oversight Committee of fifteen persons selected to represent a broad range of stakeholders to provide input into the assessment process and also canvassed the major donors as well as the Centers themselves. The findings of the Working Group were presented to the Boards of CIMMYT and IRRI meeting separately and concurrently in Shanghai on January 5, 2005 and then to a subsequent joint meeting of the two Boards on January 7-9, 2005.

At this meeting the Boards agreed formally to establish a new IRRI-CIMMYT alliance and identified four research priorities for potential first programs of the new Alliance:

- Intensive crop production systems in Asia-specifically, rice-wheat and rice-maize-and research on crop and resource management, crop genetic improvement, and socioeconomics;
- Cereals information units to provide information for researchers and partners working on genetic improvement and the management of cropping systems involving the three staples;
- Training and knowledge banks for the three crops that would take advantage of modern technologies to provide training events, the development of learning materials and education methods, distance learning, web-based knowledge systems, library services, and logistical support; and
- Climate change research directed at both mitigating and adapting the three crops to global changes that are affecting temperature, water and other factors having crucial effects on them.

In addition, to further maximize the operational efficiencies of the two Centers, the IRRI-CIMMYT Alliance will also share a range of support services. These include services related

to management of regulatory affairs for IPR and biosafety, information and communication technologies, public awareness, scientific publishing, library services, and external auditing. It also includes the sharing of the country offices of the two Centers in Bangladesh, China, India, Iran and Nepal.

Overall the agreed activities of the IRRI-CIMMYT Alliance fall far short of those proposed by the Working Group. In fact most are already happening in systemwide programs such as the Rice-Wheat Consortium (RWC) or could be expected to happen between two CGIAR Centers without the need to establish a special alliance. The lack of progress in achieving greater cooperation between Centers after many months of negotiations and meetings is likely to lead to calls for change to be imposed on the Centers from the outside putting more pressure on a system already under stress in coping with the changes it is facing.

### **1.5 CIMMYT's Responses to the Fourth EPMP Recommendations**

The 4<sup>th</sup> CIMMYT EPMP in 1997 made a total of 20 Recommendations: 4 on the Wheat Program, 4 on the Maize Program, 1 on the Applied Biotechnology Center (ABC), 2 on the Natural Resources Group, 3 on the Economics Program, 4 on Management and 2 on Governance. CIMMYT's response to these recommendations varied greatly. CIMMYT has fully implemented or made satisfactory progress on 6 Recommendations: 1, 2, 5, 6, 8 and 11. The Center has made some progress regarding Recommendations 7, 9 and 10. CIMMYT has not made progress in implementing Recommendations 3, 4, and 12-20; yet many of these are still as relevant today as they were in 1997 when they were first formulated despite the recent changes in CIMMYT's program structure and research focus.

In particular, with respect to the recommendations on the Economics Program, the Panel feels that the substance of these recommendations is still valid for the work of the Social Sciences Group. Similarly, the Center has made insufficient progress in implementing the recommendations on Management and Governance, which again are still valid. Indeed, given the strong emphasis on Board accountability in today's environment, these recommendations are probably even more pertinent now than when they were first formulated in 1997.

The recommendations of the Fourth CIMMYT EPMP, Management response to each recommendation, the actions taken since by the Center and the Panel's assessment of CIMMYT's responses are given in Appendix VI.

## 2 CIMMYT'S NEW STRATEGY

### 2.1 General Observations on the Plan and the Planning Process

In 2002, the CIMMYT board and new Director General embarked on a wide-ranging planning process that looked closely at the Center's mission, the global trends influencing CIMMYT's future, and the perceptions of the Center among partners and stakeholders. The process also included an internal assessment of strengths and weaknesses.

The plan was driven by the new DG, who naturally brought focus and energy to a process and result that would position CIMMYT more strategically as an institution and create momentum for the next stage of its organizational life. The planning process took place within a global research environment that provoked probing discussions of CIMMYT's role and value, and at a time when the financial problems CIMMYT faced had the potential to constrain its capacity for some time.

The process resulted in a new mission and organizational structure for CIMMYT that were captured in **Seeds of Innovation: CIMMYT's Strategy for Helping to Reduce Poverty and Hunger by 2020**. Linked to this document are three supporting documents:

- A digest of the key features of the plan, emphasizing the "heart of the strategy, the mind of the strategy, the muscle of the strategy and the spirit of the strategy";
- **Global Trends Influencing CIMMYT's Future**, a report that captures the research and findings relating to external trends with implications for CIMMYT; and
- **Perspectives on CIMMYT's Future**, which summarizes an external scan that involved 170 individuals representing a broad cross-section of CIMMYT's stakeholders—donors, partners, the private sector, and beneficiaries.

For the purpose of this chapter, the review Panel also includes CIMMYT's Medium-Term Plan (MTP) for 2005-2007 as an additional plan document, since it represents one of the first expressions of the implementation of the new strategy, and logframes developed by Program Directors that represent planning and priority setting for the coming budget cycle.

The Panel is acutely aware of the transformative nature of the new plan and the difficulty of implementing it where capital of different kinds—financial, human, physical and political—is not at ideal levels. In its review, the Panel looked closely at how critical features of the new strategy—goal setting, financial and business planning, priority setting and leadership—have been developed and articulated.

### 2.2 About the Planning Process

CIMMYT made a deliberate choice to engage in a process that involved extensive consultation and participation of staff and board as well as a substantial effort to look outside CIMMYT for information and perspective. A notable effort was made to identify and explore the external challenges that CIMMYT must navigate and accommodate to be successful, and a comparable effort was made to invite stakeholders to contribute their views on CIMMYT's capacities, shortcomings and strategic advantages. CIMMYT also allocated substantial time and resources to this process at a time when both were at a premium.

Although the Panel had many questions about both the new strategy and its implementation, the Panel viewed the process overall as positive in an organization that was making difficult choices and facing uncertainty about its future. The challenge will be maintaining the energy required to implement the plan fully during the disquieting interval when new priorities mandated by the strategy are identified and the change associated with them begins to take place. A particularly acute issue may be assuring staff that the planning process genuinely modelled a change in the organization's culture to a more collaborative and inclusive style of working and was not a one-off exercise.

### **2.3 About the Plan Document**

It is worth noting that the Panel chose to write briefly about the plan document before beginning to discuss the plan itself. There are a number of reasons for this. The principal one is the substantial scale and complexity of the document and the adjunct material that was produced simultaneously with it. Another is the rhetorical style of the document which presented its own challenges to the Panel as it attempted to assess the key elements of the plan, including the mission shift, the consequences of the shift, and the specific goals and priorities that CIMMYT has identified to advance its new mission.

The timing of the EPMP also meant that the Panel was looking primarily at two documents—the main plan document and the MTP for 2005-2007—each of which contained substantial gaps in terms of specific, legible descriptions of what was substantively different or new, or proposed to be different or new, as a result of the new strategy. Beyond the restructured Programs described in these documents, the critical elements that would give shape and meaning to the new strategy—particularly goals, priorities, projected results, and resource allocations—were difficult to uncover and assess.

### **2.4 Mission**

CIMMYT's new mission statement reads:

*CIMMYT acts as a catalyst and leader in a global maize and wheat innovation network that serves the poor in developing countries. Drawing on strong science and effective partnerships, we create, share, and use knowledge and technology to increase food security, improve the productivity and profitability of farming systems, and sustain natural resources.*

In contrast with the previous mission statement, which stressed the organization's character as an agricultural research and training center dedicated to helping the poor, and its focus on increasing the profitability, productivity, and sustainability of maize and wheat farming systems, the new statement places an emphasis on CIMMYT's role as a catalyst and leader in innovation and the use of strong science and partnerships as its vehicles for achieving results.

CIMMYT emphasizes that in redrafting the mission it has put people at the heart of its work, but that is more evident in the proposed strategy than in the mission statement itself. Unlike those involved in the process, the Panel does not have the advantage of having invested emotion and intellectual capital in rethinking and critiquing the essential purpose of

CIMMYT, and so may not bring to the final iteration of the mission an appreciation for the deeper meaning it has for those who developed it. This is not to dispute the strong sense within the organization that the poor are now central to CIMMYT's mission in a different way than in the past, but the Panel looked more closely at the strategy and CIMMYT's reorganization, rather than the mission statement, for evidence of this new focus on people and livelihoods as well as at CIMMYT's capacity to achieve results.

The emphasis in the mission and throughout the plan on poverty alleviation raised three questions for the Panel.

- Is this mission achievable?  
In the absence of clearly stated strategic goals that would provide a way to target and measure impact, it is hard to answer this question. Additionally, among the many conditions for success, a critical number, such as uncooperative governments, are not within CIMMYT's or its partners' control.
- Given the mission, the capacity that will be needed to achieve it, and CIMMYT's historical strengths, is the new strategy the right strategy?
- As resources are re-allocated, will there be further reductions in the breeding activities to fulfil the new mission and implement the new strategy?  
The Panel notes the loss of experienced staff in this area. Does CIMMYT risk the erosion of its key strategic advantage through undercapitalizing it or failing sufficiently to value it in the new strategy?

## 2.5 The New Strategy

In the course of outlining its new strategy and focus, CIMMYT places a priority on a holistic approach to understanding livelihood systems, impact-oriented Programs that will catalyze interdisciplinary research, decentralization of Programs, and partnerships that can leverage capacity and help accelerate results.

The re-organization of Programs describes a transformation in CIMMYT's work to a new model intended to sustain in a more focused and strategic way its important scientific work, develop its substantial scientific assets, and enable more measurable improvements in livelihood in targeted regions and poor populations. CIMMYT's past achievements—the standards of excellence and historical impact of CIMMYT's work—provided a backdrop for the new plan that raised a natural concern among Panel members that the new strategy might diffuse the underlying assets—human, scientific and physical—that produced this long record of achievement.

The Panel faced a number of challenges in assessing the likely success of the new strategy. The first was the absence of clearly defined goals that would drive priority setting as well as resource development and allocation, and that would also provide a baseline against which results could be measured over time. The word "goal" was elusive throughout the strategy documents and the search for clarity was not substantially aided by the mid-term 2005-2007 plan or the logframes produced as part of budgeting and priority setting for the coming fiscal year.

The "mind of the strategy" is described in the plan as a set of initiatives:

- Harnessing maize and wheat genetic diversity for humanity
- Strengthening the global maize and wheat innovation network through policies and institutions, capacity building, and analysis of strategic global issues
- Reducing vulnerability in dry land, stress-prone, food-grain systems by managing risk
- Improving livelihoods and conserving natural resources in tropical agro-ecosystems
- Safeguarding food security in densely populated areas through sustainable intensification
- Increasing food security in Africa through better technology and improved markets

These six initiatives drove the re-structuring of the Programs into two global and four regional Programs with a proposed multi-disciplinary character, each of which has a mandate. For example: Program1: Genetic Resources: Harnessing maize and wheat genetic diversity for humanity, or Program5: Tropical Ecosystems: Improving livelihoods and conserving natural resources in tropical ecosystems.

As the Panel moved from these descriptions to the MTP, it was increasingly difficult to see a clear progression from mission to goals and then priorities, to tactics and activities designed to achieve goals, to resource allocation and evaluation of outputs.

The second challenge the Panel faced in assessing the new strategy was the relative newness of the plan combined with the degree of staff turnover that coincided with the initial round of goal and priority setting that took place in late 2004. It seems clear that Program Directors who were leaving CIMMYT may not have brought the same degree of energy or rigor to this exercise as the new team of Program Directors. During its second visit to the Center, the Panel found evidence that new Directors had begun to revisit the earlier exercise and re-shape the implementation plan for the new strategy. Clearly, it was not possible to see this in the MTP but it was more evident on a program-by-program basis from documents produced since the end of 2004.

***The Panel recommends that senior Management and Program Directors undertake a much more rigorous process to define goals for the new strategy that provide a framework within which to organize projects and activities and against which progress in meeting the goals can be measured. In addition to strengthening the implementation of the new strategy, the process will enable the Program Directors as a team to identify a set of goals that are congruent across the Center.***

In general, the Panel faced a difficult time learning from management the degree to which CIMMYT was about to engage in new initiatives as a result of the new strategy, what they were, and how their goals and outputs would be accomplished. CIMMYT's current resource portfolio results in a set of restricted projects that have outputs and timeframes created to work within the old structure. These cannot be abandoned and may not be subject to much adjustment with the result that it appeared to the Panel that for the foreseeable future the new CIMMYT strategy looks like the old strategy with nominally different programmatic "homes."

Chapter 4 explores this issue of what changes and what remains the same more specifically, and includes the Panel's detailed assessments and recommendations for the Programs.

## 2.6 A Need for a Business Strategic Plan

The adoption of a strategic plan is usually accompanied by both a business strategic plan and an operational plan, which together address the issues of resource allocation and mobilization as well as implementation. A business strategic plan is not just a projection of the budget from year to year, but an exercise in which the effect of maintaining resources, increasing resources or losing resources is applied to the underlying goals of the plan to help refine priority setting and sharpen impact.

To solve the problem of recent budget shortfalls, the tactic has been to assess a combination of across the board cuts and strategic staff reductions. The new strategy implies an initial resetting of priorities and programmatic investments, but does not take that process forward to project potential financial results and define how each scenario—the same, more or fewer resources—would impact priority setting and implementation of the plan.

A business plan helps address the important issue of critical mass: what does it take for a particular goal to be achieved? Some activities must achieve a certain size or level of capacity to be able to approach a result worth the investment of limited resources. Other activities can be reduced and still be effective.

While the Panel could see that this set of assessments had been made as the new strategy was developed (the external scan and the study of global trends, in particular, provided important insights for mission and priorities), it could not find that the assessment process was reproduced as a forecasting and decision-making tool that would support the plan as it was implemented over time.

*The Panel recommends that CIMMYT develop a business strategic plan that will support the successful implementation of the new strategy in the face of a dynamic financial environment.*

## 2.7 Implementation and Priority Setting

Chapter 4 addresses the issue of implementation and priority setting more specifically for each Program and disciplinary group.

### 2.7.1 New Research Matrix

CIMMYT has organized its research into a matrix management structure intending to have thematic Programs (global and eco-regional) on the horizontal axis, which interact with five disciplinary groups on the vertical axis. The thematic Programs are charged with catalyzing interdisciplinary research done in collaboration with a wide range of partners by maintaining a focus on livelihoods and production systems rather than on commodities and disciplines. The disciplinary groups have the task of ensuring continuing scientific and professional excellence.

The Panel perceives two potential problems in making the research matrix work. The first is the thin distribution of certain disciplinary expertise across the eco-regional Programs. The

second is the difficulty of clarifying lines of authority with a structure that includes Program directorship, project management and disciplinary leadership. In addition, the long recommended introduction of a project management system needs to be accelerated to have the new structure function effectively.

The management team, including Program Directors, has developed new terms of reference for each Program and disciplinary group within the matrix. These need to be adopted and then evaluated to be sure that those responsible for achieving results have the authority to do so. Training should be provided to key Program staff to enable them to participate appropriately in the new strategy and to operate within the new system for project and financial management.

### **2.7.2 Priority Setting**

To achieve a similarly formatted set of results using comparable criteria, CIMMYT adopted a simple set of processes for identifying priorities and estimating resources. These enabled Program Directors to produce plans that could be compared across Programs. The objective was to:

- Prioritize objectives, outputs and activities
- Assign resources to objectives, outputs and activities
- Make explicit the trade-offs that limited resources entailed

In the absence of clearly delineated goals and without the additional dimension of planning with different resource scenarios (flat resources, increased resources, decreased resources), the format and formulas that were developed, while worthwhile, yielded results of limited strategic value for implementation within and across Programs. Given the current level of restricted project support, it is not clear that even with a more robust process, this exercise highlights more than capacity needs going forward.

### **2.7.3 Program Directorship and Management Team**

The Panel noted earlier in Chapter 2 that a new team of Program Directors is in place and the DG's office now includes a Deputy Director General for Research (DDG-R) and a Director of Corporate Services. This is an exceptionally strong team, recruited with the new strategy in mind. It appears to the Panel that the Directors are a critical part of re-stabilizing CIMMYT and rebuilding a collective sense of purpose. If CIMMYT wishes to capture fully the new vision, talent and energy that the new project directors, in particular, bring to their assignments, it must provide them with the flexibility to fine tune implementation, shape their staffs, and adjust the pace of change to build good will and the personal sense of value that success will ultimately depend on.

## 2.8 Medium-Term Plan 2005-2007

As an expression of the strategy's implementation, the MTP for 2005-2007 is an unsatisfactory document. It is both unclear and incomplete. Its shortcomings are only partially offset by the Program logframes that have been developed as part of the fiscal '06 budget and the development of the new MTP.

The MTP should reflect the implementation of the new strategy and build on the experience of the previous MTP. At a minimum, it should fully elaborate each Program's work plan for 2005, and outline the research agenda for the next two years. At the project level, it should detail the research outputs that change the probability of success of a project in the portfolio, as well as changes, if any, in the resource requirements since the last submission.

CIMMYT's MTP was not prepared in accordance with the guidelines issued by the Secretariats of the CGIAR and Science Council. The MTP lacks major financial tables to provide information about the financial viability of the plan as well as the comprehensive project portfolio that provides comprehensive information on each project including milestones, collaborators and resource requirements needed for evaluation and monitoring.

It is the Panel's view that the MTP 2005-2007 does not function as an operational plan for implementation of the strategy or for evaluating and monitoring progress of the research agenda. In addition to the missing financial tables, the following were also missing or incomplete:

- Project structure and outputs under the Programs: From the MTP it is not clear what projects and outputs the Center will undertake to implement the research Programs, and their expected impact.
- Project Portfolio: The MTP 2005-2007 lacks the entire project portfolio with provides specific information on each project that is needed for evaluation and monitoring progress. Each project descriptor should include objectives, expected gains/impact, outputs, and milestones for each output, cost for three years, users of research, collaborators, CGIAR linkage and funding sources.

The MTP did not make clear to the Panel how Program priorities were set and resources allocated. To the extent the Panel had access to this information it was through one-on-one interaction with Program staff and senior management. While the Panel recognizes that the implementation process linked to the new strategy could not be fully accomplished by the deadlines established for the production of the MTP, the completion of the strategy document and the development of the MTP for 2005-2007 provided a large enough window to enable more of the implications of the plan to be evident in the MTP. The MTP is an increasingly important document for management, board and other stakeholders to gain insight into CIMMYT's Programs, priority setting, resource allocation and results; it needs to be more informative about these matters as possible in the coming editions.

## 2.9 Resource Allocation and Mobilization

The MTP for 2005-2007 suggests that the new strategy will be implemented by only incremental growth in budgetary resources. The growth in resources for non-salary uses is narrowed even further after the cost of new staff hires is included.

Even if the new strategy envisions substantial operational efficiencies with associated savings on the expense side, the new strategy and the impact it envisions would seem to mandate projecting and seeking new and renewed resources. Even in 2007, four years after the strategy is adopted and two years after implementation is complete, there is little evidence based on the budget projections that CIMMYT plans to use the new strategy to mobilize new resources.

It is understandable that implementation, including resource allocation during the first two years of the plan, will be driven in part by the overarching financial constraints that CIMMYT faces. Nevertheless, there are clear areas within CIMMYT's Programs where failing to make additional investments quickly will result in the loss of any future strategic value for a Program or activity. The Panel's concerns extend to a number of new programmatic emphases and goals and the difficulty of making a measurable impact with the current levels of capacity. There are questions here of both investment and choice. The Panel perceives a continuing need to refine CIMMYT's strategy to invest where it can make a measurable difference rather than adopting a range of initiatives which may be important and within CIMMYT's new mission, but which CIMMYT cannot hope to impact with any degree of measurable success even within an extended timeframe.

In particular, the Panel had a persistent concern that the multidisciplinary organization of regional work, requiring both new staff capacity and also new levels of collaboration and partnership to be effective, may tax CIMMYT's current resource base and weaken its investments in crop breeding. The Panel suggests that this strategy be tested in a setting, such as southern Asia, where the chance of success is likely to be high to see if the new direction actually works. In an organization that appears to have built its strategy on level and mostly restricted funds, it seems prudent to the Panel to invest resources in the new model in a way that minimizes risk and increases the value of learning from results.

The MTP subsumes within the Program and disciplinary matrix the plan for rebuilding CIMMYT's management and physical infrastructure. Given the degree to which both aspects of CIMMYT's operations are in need of improvement and the extent to which CIMMYT's overall organizational stability is dependent on them, the Panel **suggests** that the resource requirements for this component of the strategy's implementation be identified along with the underlying goals and outputs.

For the Panel's purposes, it considers the ability of CIMMYT to attract and retain a talented staff a critical part of the resource component of a successful plan. As noted in the Chapter 9 of the report, the level of turnover and the morale of staff have reached a critical low. CIMMYT cannot undertake its new strategy or maintain its organizational integrity if it continues to lose its staff, particularly its scientific staff. The Panel **urges** CIMMYT

management to consider carefully how morale can be improved, how to reassure the staff that their patience and goodwill will be rewarded, and how to provide Program Directors and other staff with the resources to work effectively within the framework of the new strategy. CIMMYT has committed itself to becoming a learning organization but it needs to retain the commitment and faith of the staff for that organizational culture to thrive.

Chapter 9 discusses in detail the need for CIMMYT to build a much stronger and professional resource mobilization strategy. It cannot hope to be competitive and to build the resources it needs on a sustained basis without a more aggressive, well planned approach to fund raising and donor relations. The new strategy offers a significant opportunity to build greater support for CIMMYT's mission and Programs, but that opportunity has a limited life span.

## **2.10 Conclusion**

The Panel valued the scale and openness of the planning process. It was particularly impressive to see stakeholders' assessments of CIMMYT, most of which were highly positive but many of which were startlingly candid, taken seriously and reflected in many areas of CIMMYT's new strategy. It was also a process that enabled board and staff to work together in a thoughtful and reflective manner about CIMMYT's mission and the strengths the organization brings to fulfilling it.

**Seeds of Change** captures CIMMYT's bold new vision and mission, and documents the extensive research and discussions that led to the strategy's formulation. While the Panel understood the publication's importance as a record, it considered the document deficient in expressing clearly the goals, and linked to them the priorities, resource requirements and results, that CIMMYT would pursue in order to achieve the new strategy. The work CIMMYT has undertaken since adoption of the strategy to clarify its goals and build an implementation plan continues.

The scope of the new mission and the breadth of the new strategy in combination with CIMMYT's challenging financial circumstances created a high degree of uncertainty within the Panel about the extent to which the strategy and the attendant reorganization will be successful.

***The Panel recommends that CIMMYT Management and Board undertake a mid-term review in 2007 focused on the implementation of the new strategy, the efficacy of CIMMYT's reorganization and the impact of financial capacity on CIMMYT's Programs and operations.***



### 3 RESEARCH ACCOMPLISHMENTS

In this Chapter we assess the outputs and impacts of CIMMYT's research since the last EPMR. Since the new CIMMYT Programs have not been in place long enough to generate significant independent impacts in their own right, the Panel chose to do this assessment on the basis of the old program structure.

#### 3.1 Wheat Program

The Wheat Program was a core program at CIMMYT from its establishment in 1966 until the implementation of the new program structure in 2004. Approximately 66-75% of the total budget devoted to wheat research has been spent on breeding and related activities (cereal chemistry, plant pathology, biometry and genetic resources) over the years, and this trend continued until the program ceased in 2004. In 2002 CIMMYT's expenditure on the improvement of bread wheat, durum wheat and triticale was estimated to be at US\$ 9.11 million<sup>1</sup>. The bulk of this expenditure was on bread wheat with limited resources going to durum wheat, barley and triticale.

Initially the emphasis was given to breeding wheats for irrigated or well watered subtropical environments which were the initial sites for the green revolution. However, the focus gradually expanded over the years to include the full complement of maturity types (spring, facultative, and winter) for all the major wheat growing regions of the developing world. In recent years, particular emphasis has been given to breeding wheats with greater biotic and abiotic stress tolerances for marginal rainfed environments.

In 1990 CIMMYT initiated a global study designed to document the adoption and diffusion of CIMMYT germplasm in the developing world and to assess the benefits generated by its wheat improvement program in concert with its NARS partners. This early study underlined the outstanding success of the CIMMYT wheat improvement program and quantified the huge impact that CIMMYT had on the global wheat industry. It concluded that: (i) the adoption and diffusion of improved wheat varieties has continued in the post-Green Revolution era. By the 1990s improved high yielding cultivars covered over 80% of all the wheat area with adoption rates of 90% or greater in Latin America and Asia outside of China; (ii) improved germplasm developed by CIMMYT's wheat improvement program continues to be used extensively by breeding programs in developing countries; (iii) public investment in international wheat breeding generates high rates of return. Byerlee and Traxler<sup>2</sup> estimated that the total economic surplus in developing countries from genetic improvement in wheat was about US\$ 2.5 billion annually for a total research cost that never exceeded US\$ 70 million.

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<sup>1</sup> Lantican, M.A., H.J. Dubin, and M.L. Morris (2004), Impacts of International Wheat Breeding Research in the Developing World, 1988-2002. CIMMYT (in press)

<sup>2</sup> Byerlee and G. Traxler (1995), National and International Wheat Research in the post-Green Revolution Period: Evolution and Impacts, American Journal of Agricultural Economics 77(2): 268-278.

### 3.1.1 Outputs

The outputs of the CIMMYT Wheat Program since the last EPMR in 1997 are discussed below.

- Continuing output of high yielding bread wheat lines in a range of maturity classes with broad-based resistance to leaf, stem and stripe rusts that can be used by cooperating NARS breeding and evaluation programs directly as cultivars, or more commonly, as parents.
- New combinations of non-specific genes for leaf and stripe rust resistance in advanced breeding lines with competitive yields and acceptable quality. It is anticipated that this form of multigenic and non-specific resistance will not directly challenge the pathogens to mutate to more virulent forms and hence prove more durable in the field. In addition CIMMYT has been working with its Advanced Research Institutes (ARI) to develop molecular markers for each of these genes so that effective combinations can be maintained in future breeding cycles both at CIMMYT and in the NARS partner programs.
- Establishment of the Global Rust Monitoring Nursery as an early warning system for the detection and monitoring of new damaging races of rusts on advanced wheat lines. The nursery was established in response to a virulent race of yellow rust that could attach to previously universally resistant varieties and spread from East Africa where it arose in 1986 to North Africa crossing West Asia and South Asia to reach Nepal in 1997. On the way it caused multi-million dollar production losses in several countries, which could have been avoided through coordinated global monitoring coupled with local variety replacement. This nursery coordinated by CIMMYT involves the cooperative efforts of more than 30 NARS in the developing world and aims to avoid a repeat of these past unnecessary losses.
- Production of over 1,000 synthetic wheats using wide crossing between tetraploid wheats and goat grass which have provided exciting new sources of resistance or tolerance to a range of biotic and abiotic stresses of wheat.
- Use of synthetic wheats to develop bread wheat germplasm better adapted to marginal environments with better seedling vigour, improved drought tolerance and greater yield potential.
- Identification of a range of wheat germplasm including landraces from Turkey and a number of wild relatives that are tolerant of zinc deficiency and others that produce zinc rich grain. These materials are now being incorporated into advanced breeding lines that can be transferred to NARS partners.
- Higher yielding durum germplasm with better industrial quality (yellow pigment and gluten characteristics).
- Improved Triticale germplasm of both grain and dual purpose types and development of an effective system for the commercial production of F1 hybrid Triticale.
- CIMMYT germplasm incorporated in more than 800 released cultivars of bread wheat, durum wheat, barley and triticale globally over the period 1999-2004 inclusive.

The Wheat Program produced some 190 peer reviewed publications during 1999-2004 (Table 3.1), on average 0.8 per researcher annually (1999-2003). This is a good record within the Institute. Eighty five percent of these publications were done jointly with partners including nearly equal participation with institutions in the South and the North. The Program also produced 15 other publications, including research reports and tools, manuals, proceedings

and bulletins. Through these publications the Wheat Program has made a significant contribution to the scientific literature in the areas of breeding for disease resistance, drought and industrial quality and the exploitation of wide crosses in wheat germplasm improvement.

**Table 3.1 – Wheat Program Publications and Staff 1999-2004**

	1999	2000	2001	2002	2003	2004
All peer reviewed publications	20	25	33	28	46	40
Jointly with partners	16	21	28	24	38	36
In regional journals	5	3	7	11	12	10
Staff	32	37	40	39	39	na
Peer-reviewed articles/staff member	0.6	0.7	0.8	0.7	1.2	

### 3.1.2 Impacts

The second global wheat impact study undertaken by CIMMYT from 1997 to 2002 (see p. 21) confirmed the results of the earlier extensive study and showed that improved germplasm from CIMMYT's bread and durum wheat improvement programs continued to be extensively used by developing countries. CIMMYT germplasm had its biggest impact in spring types with over 90% of the approximately 80 new cultivars of both bread and durum wheat released on average each year having at least one CIMMYT ancestor world wide.

It is also clear from the most recent studies that the International Winter Wheat Improvement Program (IWWIP), a joint venture between Turkey's Ministry of Agriculture, CIMMYT and ICARDA, is having a significant impact in CWANA where winter and facultative wheats predominate. The IWWIP distributes improved winter wheat germplasm to 120 breeding programs in 50 countries. To date, 30 varieties developed by IWWIP have been released and a further 34 are scheduled for release. It is anticipated that the improved winter wheats developed by IWWIP will significantly lift the low average yield of 1.3 tons per ha on the 16 million ha of wheat grown in the CWANA region.

The extensive use of CIMMYT germplasm by developing country breeding programs combined with the widespread adoption of CIMMYT derived varieties generates enormous economic benefits for those countries. Using 2002 adoption data, the annual benefits associated with the use of CIMMYT derived germplasm were estimated to range from US\$ 0.5-1.6 billion (2002 dollars) under the most conservative assumptions and US\$ 1.3 to 3.9 billion dollars under more liberal assumptions. These figures confirm that the investment in CIMMYT's wheat improvement program given its modest cost and huge returns remains extremely attractive.

However, yield increases per se while obviously extremely important are only part of the story. CIMMYT has also invested heavily in maintenance breeding, not only in durable resistance to leaf, stem and stripe rust in bread and durum wheat, but also for a number of other pests and diseases such as Russian wheat aphid, nematodes, head scab and fungal root diseases. This maintenance breeding is important for two reasons. First it helps underpin stability of production for small scale farmers, which reduces their vulnerability to the loss of

food or income. Second, it reduces the need to use chemicals to control disease reducing input costs and improving environmental sustainability. Despite the size and importance of the maintenance breeding effort there have been few attempts to quantify the benefits of maintenance breeding even though agronomic studies suggest that progress in protecting yields through disease resistance may be greater than advances in yield potential (Sayre et al. 1998). A recent case study of the economic impact of productivity maintenance research using the yield losses avoided by breeding for durable resistance to leaf rust as the example has demonstrated very significant benefits. The internal rate of return on CIMMYT's research investment in leaf rust resistance research and breeding since 1973 was estimated to be 41%. When discounted by 5%, the net present value was US\$ 5.36 billion in 1990 dollars and the benefit:cost ratio was 27:1. This study clearly illustrates the economic importance of maintenance breeding and research in international crop improvement programs.

The international wheat breeding system is still largely dominated by public breeding programs but the number of private companies that also engage in wheat breeding is expanding relatively rapidly mainly in developed countries but also in a number of developing countries. These private wheat breeding companies are usually interested in exerting IPR in the form of Plant Breeders Rights or patents over their released cultivars to generate income from seed sales and/or end point royalties. One of the issues for CIMMYT was whether the growing number of private wheat breeding companies would be reluctant to use its germplasm because of concerns that ownership rights might be difficult to assert because CIMMYT cannot offer exclusive rights to individual companies. However, a recent analysis<sup>3</sup> using a sample of five countries indicated that more than 75% of the protected wheat varieties in Argentina, Brazil, Chile and Uruguay have some CIMMYT ancestry close to the figure for the public sector programs in the region. In South Africa the proportion of protected wheat lines with CIMMYT ancestry was less (45%). The figures do not reflect the reluctance of private companies to use CIMMYT germplasm but rather its lack of adaptation to some production environments of importance in South Africa.

### 3.1.3 CCERs and Other External Reviews

The Panel had for its consideration the reports of two external reviews. The first was the CIMMYT Sub-Panel Report of the Systemwide Review of Plant Breeding Methodologies in the CGIAR carried out in February 2000 by a distinguished Panel of experts. This review was commissioned by the TAC on behalf of the CGIAR to assess the extent to which appropriate biotechnology and bioengineering techniques are being practiced to provide support to more conventional breeding practices.

This review made a total of 18 recommendations arising from its review of CIMMYT's plant breeding methodologies. Three were specific to CIMMYT's wheat improvement program notably:

- *Recommendation 6:* There is a need for a stronger commitment and closer collaboration with the ABC for a steady progress in moving biotechnology into wheat breeding programs.

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<sup>3</sup> Lantican *et al* (2004). *Loc.cit.*

- *Recommendation 7:* The Wheat Program together with the ABC should make an internal assessment of costs and opportunities of biotechnology for its breeding endeavours, identifying priorities and specifying commitments and timing.
- *Recommendation 8:* More attention has to be devoted to more traditional techniques as production of double haploids in wheat. Bread wheat haploids should be produced not just for research projects, but at a larger scale for the breeding programs. Research for production of double haploids in durum wheat is also needed.

In addition to the above three recommendations this review also raised the issue of data acquisition, data management and data sharing capabilities and recommended these be upgraded through the co-operative development of ICIS (International Crop Information System) with other CGIAR Centers. These recommendations, especially 8 above, are still valid today. However, it is unclear what the Centers response, if any, was to these recommendations.

The second was the Center Commissioned External Review (CCER) of CIMMYT's Wheat Breeding Activities conducted in March 2004. This review was also conducted by a distinguished panel of international experts and was assigned the task, by the CIMMYT Board of Trustees, of assessing the effectiveness and efficiency of CIMMYT's wheat breeding approaches, with specific emphasis on the following issues: a) the quality and relevance of CIMMYT's wheat breeding programs; b) the effectiveness and efficiency of the current wheat improvement system with emphasis on the use of modern technologies, especially biotechnology; c) opportunities to improve the effectiveness and efficiency of the current wheat improvement programs, including the role of CIMMYT in the wheat breeding system, and the role of regional testing and feedback mechanisms; d) the effectiveness of partnerships that CIMMYT's Wheat Program has with NARS, ARIs, NGOs and the private seed sector for wheat breeding and seed dissemination; and e) the scope and relevance of the wheat improvement programs, particularly their impact on poverty reduction and food security in developing countries.

Overall the CCER team endorsed the general thrust of CIMMYT's wheat breeding activities. However, the CCER team made 18 recommendations covering many aspects of the operation of CIMMYT's wheat improvement activities in areas as diverse as staff succession, postdoctoral training, impact assessment, communication with CIMMYT partners, mechanization of the breeding program, MAS, breeding strategies, data acquisition and management and the CIMMYT-ICARDA relationship. Generally, management responded positively to the recommendations of the CCER and has identified steps they are taking to resolve most of the issues identified by the CCER panel. The EPMR Panel fully supports the findings and recommendations of this recent CCER.

#### **3.1.4 Assessment**

CIMMYT's wheat improvement program has continued to be highly productive since the last EPMR in 1997. It has produced a constant stream of exciting new advanced lines with improved yield, disease resistance, seedling vigour, alternate dwarfing genes, drought and heat resistance and tolerance to zinc deficiency. The research output of the program especially in the areas of durable resistance for leaf and stripe rust resistance and the use of synthetics to broaden the genetic base of bread wheat breeding has also been exceptional.

This performance has been more remarkable given the significant changes to the program over the last three years. These have included the loss of several long term senior staff from the breeding and wide crossing programs and the gene bank; a reduction of 35% in total staff in the program since 2001; and a radical reorganization of the program and line responsibilities. The EPMR team congratulates the remaining staff on their dedication and capacity to remain focused on their important work during this extended period of transition.

## 3.2 Maize Program

### 3.2.1 Introduction

CIMMYT's maize improvement program began in 1966 with the founding of the Center. It has targeted all the lowland tropical, subtropical, mid-altitude, and tropical highland environments throughout the world. IITA, located in Nigeria, conducts a complementary program on maize improvement for the humid tropical and moist savannah zones of west and central Africa. This chapter assesses the outputs and impact of CIMMYT's maize program since the 4th EPMR until the program's discontinuation in 2004. This assessment is based on the regional impact studies conducted by CIMMYT, External Review reports (see Section 3.2.4), and other documentation and information collected at CIMMYT headquarters during the course of the review.

Faced with the funding constraints, work in Asia was reduced. The Bangkok office and the field research program in Thailand were closed in 2002. Benefiting from increased donor interest in SSA, activities increased substantially during the mid to late 1990s.

Until the restructuring of CIMMYT programs, maize research was carried out by six major units in the CIMMYT Maize Program:

- **Eastern Africa** (headed by Alpha Diallo), **Southern Africa** (headed by Kevin Pixley; 12 staff in total on average)
- **Genetic Resources**, headed by S. Taba (1.5)
- **Tropical Highland**, headed by D. Beck (2)
- **Subtropical mid-altitude**, headed by G. Srinivasan (2)
- **Tropical Lowland**, headed by H. Cordoba (6)

### 3.2.2 Outputs

#### 3.2.2.1 *Germplasm with Specific Traits*

The major output from the past six years of CIMMYT's maize research is the production of Modern Varieties (MVs), including numerous Open Pollinated Varieties (OPVs), improved germplasm, CIMMYT maize lines and commercial hybrids that have been released or used in breeding. The materials distributed by the 5 maize units with important new traits include:

- Drought tolerant hybrids and OPVs
- Quality Protein Maize (QPM) hybrids and OPVs
- Herbicide resistant hybrids and OPVs for Striga control
- Germplasm adapted to African highlands
- Germplasm with conventional stem borer resistance
- Several top lines used by the public and private breeding sector

A recent study<sup>4</sup> forecasts further contribution in 2005 by CIMMYT's newly released drought-tolerant MVs to maize productivity in SSA. In 2004, ten OPVs were under large scale seed increase in eight countries in southern and eastern Africa and planting of this drought tolerant material is expected on about 1 million ha. Yield increases are estimated to be about 15-20% compared to formerly used OPVs. Potentially about 10% of the total of 10.6 million ha of maize grown in these countries will switch to improved MVs in one year. Whether any of this 1 million ha will be planted on smallholder farms and whether the uptake of the new MVs will result in sustainable changes in livelihoods is not known.

Considering the challenge of serving all diverse areas well, CIMMYT's maize research priorities have been balanced, and positive results are documented from many parts of the world. In Africa, the improved MVs show excellent results under lower-yielding conditions, but they have not yet been widely distributed and have not been adopted by the resource-poor smallholder farm families.

The achievements around the world are the results of the strong core maize breeding program in Mexico where diverse conditions can be fully exploited to test for different globally important traits. This is discussed later.

Through pre-breeding CIMMYT's gene pools and populations have been re-structured into clearly separated heterotic groups, while at the same time broadening the gene pools that are adapted to tropical, subtropical and highland climatic conditions. This is done by introgression of germplasm accessions as well as elite cultivars. Such improved gene pools and breeding crosses are enhanced within the respective heterotic pattern.

Investment in pre-breeding has increased since 1999 in two areas:

- ex situ: crosses of core landraces with elite inbreds incorporated into heterotic genepools; and
- in situ: targeted incorporation of desirable traits into local varieties; and comparison of selectable characteristics at the molecular level.

In Africa CIMMYT materials provide a major source of disease resistance to a range of pests and diseases, and characterization of new maize germplasm products, based on regional trials at up to 100 locations, is published annually.

#### 3.2.2.2 *Quality Protein Maize*

A major achievement of recent years has been the development of QPM, for which CIMMYT scientists received the World Food Prize in 2000. Stabilizing a recessive trait in high quality background took several decades of painstaking research efforts.

Since the initial success, the various QPM projects have been successful in incorporating the trait into a broad range of materials. This success derives from CIMMYT's long-term commitment to improving aspects of maize critical to the end users. However, as the quality

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<sup>4</sup> Maize Improvement 1999-2004 and future challenges, CIMMYT 2004

protein trait is recessively controlled, seed multiplication and dissemination need to be closely monitored to assure that the consumers in urgent need of the nutritional benefits get them. Monitoring the effects of this trait throughout all steps of seed multiplication should be a major task for CIMMYT and its partners in the future. More scientific studies are needed on the positive nutritive value and impact of farmer produced QPM grains in human diet.

The total area on QPM maize grown in CIMMYT's target area is estimated to be in 2005 0.8 million ha<sup>5</sup>. There is now a wide QPM base with adaptation to Africa.

### 3.2.2.3 Publications from Maize Program

One of the outputs from CIMMYT's maize research is new knowledge and publications. CIMMYT has accumulated knowledge on the genetics base of important traits; new breeding approaches, including participatory evaluation methods, like the Mother-Baby methodology; new knowledge about host plant resistance to important pests, stem borers, maize weevils and LGB; and a better understanding of gene flow.

In the period 1999-2004, the maize researchers published a total of 69 peer-reviewed publications (Table 3.2), on average 0.7 publications per staff member annually (1999-2003). Other publications, 38 in total, included research reports, technical bulletins, manuals, proceedings and research tools. Increasingly the maize researchers published with partners from North and South and 60% of the publications were done jointly with partners with equal number of partners from North and South.

**Table 3.2 – Maize Program Publications and Staff for 1999-2004**

	1999	2000	2001	2002	2003	2004
All peer reviewed publications	9	10	11	15	17	7
Jointly with partners	4	6	10	9	7	5
In regional journals	2	2	4	3	3	1
International staff	28	29	25	30	33	na
Peer-reviewed publications per staff	0.3	0.3	0.4	0.5	0.5	

CIMMYT has also produced software for management of maize breeding programs, spatial analysis and GIS applications, such as the Maize Atlas and Country Almanacs. A large part of CIMMYT's training has focused on maize breeding, pests and pathogens, management and quality (see section 7.4).

### 3.2.3 Impacts and Assessment

Maize research at CIMMYT has made a continuous and substantial contribution to the increase in maize production in developing countries. CIMMYT's inbreds, hybrids, improved breeding pools, populations, synthetics and OPVs have been used by public and private sectors worldwide for breeding, MV release, seed production and distribution. The

<sup>5</sup> Progress Report 2003 by CIMMYT and the Nippon Foundation

quality and quantity of CIMMYT maize breeding has been documented in a recent book by Evenson and Golan (Impact of CIMMYT Maize Breeding Research, Chapter 7. An earlier impact study by Morris and Pereira (1999) indicated that nearly 300,000 metric tons of maize seed were sold in Latin America in 1996, and that of 15 million ha were planted with F1 seed (hybrids and OPV's), and 17 million ha planted with recycled seed, 75 % (12.75 million ha) contain CIMMYT's germplasm.

Considering that information is not readily available, particularly from the private sector, it is likely that CIMMYT's entire contribution to maize improvement is much larger than documented in regional studies.

Production figures from 1993 to 2003 shared with the Panel show substantial percentage increases in productivity per ha in countries like: Cameroon (123%), Senegal (79%), Burkina Faso (21%), India (31%), Indonesia (48%), Thailand (32%), Vietnam (81%), Philippines (19%), Salvador (23%), Nicaragua (27%), Bolivia (25%), Colombia (37%), Peru (28%), Venezuela (16%) and Brazil (46%).

Such figures clearly indicate the contribution of CIMMYT's germplasm via inbreds, breeding material and MV's. Most of the countries listed above do have a well functioning seed system in place which is capable of incorporating CIMMYT's maize research results into improving MVs that are released for farmers through marketing of high quality seed. The FAO statistics on maize production and productivity verify these findings. However, there is no evidence to show whether productivity in the resource poor farming areas of the world has been improved and whether the improvements, if any, could be attributed to the CIMMYT germplasm. This summary the use of CIMMYT's germplasm worldwide reflects 40 years of applied conventional breeding that has benefited maize growing farmers around the world.

CIMMYT breeders have been able to introduce genetic differentiation in every breeding generation, fully utilizing the different conditions in the maize breeding stations in Mexico. The combination of natural and artificial inoculations and infestations of diseases and pests, and exposure of germplasm to different stress factors in very different climatic conditions both during the main and off seasons have allowed the development of resistance and tolerance for many biotic and abiotic stresses common around the world where CIMMYT germplasm is used. This explains the very high proportion of CIMMYT maize germplasm grown worldwide that has been developed at the breeding stations in Mexico. CIMMYT needs to maintain this strategy of breeding at the Mexican breeding stations to secure the continuous success of CIMMYT's germplasm. CIMMYT's comprehensive maize research structure, which combines breeding in Mexico with activities in SSA must not be reduced. This structure guarantees genetic gains that are urgently needed for the more than 40 million ha of marginal, low yielding maize growing areas in the world. These areas are unlikely to have a viable profitable seed delivery system in the foreseeable future unless yields go up and proprietary breeding takes place.

The recent successes in SSA demonstrate what a continuous multidisciplinary breeding effort on drought tolerance can achieve. It is important to note that 30 years of research is underpinning the significant progress seen in 2004 and 2005. It demonstrates the long-term

nature of germplasm enhancement which needs to be accommodated also in the new strategy and program structure. In order to fulfil its mission, CIMMYT needs to maintain such an operational platform.

#### **3.2.4 CCERs and Other External Reviews**

In its assessment of CIMMYT's maize breeding activities, the Panel was able to draw on two external reviews, both conducted by distinguished international panels of experts: (i) Report of CIMMYT Maize Program External Review conducted in 2002 and (ii) CCER on CIMMYT's Maize Improvement Programs in Sub-Saharan Africa conducted in 2004.

The CIMMYT Maize Program External review (2002) was commissioned to examine the effectiveness and efficiency of CIMMYT's maize improvement efforts. The panel made several recommendations for enhancing the planning and execution of the future strategies of the Maize Program. The report concluded that CIMMYT maize breeding was highly professional, the breeding methodology was sound and results fulfilled the needs of their regional clients. The Panel concurs with the general findings of the report. Most critical is the need for a full-time data manager dedicated to the maize research even under the new program structure. CIMMYT has recognised this need.

The 2004 CCER reviewed CIMMYT's activities in SSA with a particular focus on the impact of stress tolerant maize germplasm and related crop and natural resource management (NRM) systems on smallholder, subsistence farmers' livelihoods. It concluded that important contributions had been made to the livelihoods of the resource poor maize producers and to Africa's maize industry since CIMMYT staff was based in the region in the mid 1970s. The report confirms that CIMMYT has provided essential support in program design, breeding methodology, trait characterisation, trial evaluation, staff training and capacity strengthening. The report raises concerns, however, about the formidable challenges that CIMMYT is facing to fulfil its comprehensive and ambitious targets ranging from developing biotic and abiotic stress tolerance in maize to strengthening collaboration, contributing to policy development, and documenting impacts. The Panel agrees that such targets require substantial human and financial resources, careful budgeting, excellent leadership, and strategic partnerships. The EPMR Panel endorses particularly the CCERs recommendations calling for (i) a framework for identifying feasible and realistic intervention options with clear impact pathways for improving the livelihoods of poor maize producers; and (ii) a pragmatic business plan. The EPMR Panel emphasises the importance that CIMMYT dedicating its own efforts as well as catalyzing partners to target the resource poor farming areas where yields are very low and farmers so far have not had access to improved seed. It also encourages CIMMYT to engage more in collaboration with the other Centers and advanced institutions to advance its goals in this area.

#### **3.2.5 Conclusions**

On the basis of maize production and yield statistics shared with the Panel in CIMMYT's target countries, four different kinds of countries can be identified in terms of yield increases: (i) 2 to 3 fold; (ii) 1.5 to 2 fold; (iii) only slight increases; and (iv) no yield increase or even decrease of yield/ha.

It is obvious that germplasm improvement and better agronomic practices have not yet reached the resource-poor smallholders for whom maize is a staple food and feed. CIMMYT's germplasm improvement over the last 3 decades has had uneven success in the maize farming community of the mega-environments targeted by CIMMYT. In designing its future maize strategies, CIMMYT needs to distinguish between areas with different potential.

The high- and medium-yielding regions need much less attention than the low- and very low yielding regions in order to contribute to reducing poverty and hunger.

In order to serve the low and very low yielding regions best, the causes of low yields and low technology adoption in comparison with the productive areas need to be well understood. This was emphasized by the CCER. Most countries that CIMMYT has targeted, include all four different types of areas, but there is limited detailed information on the low- and very low yielding areas in these countries. Such regions with low production and productivity may be described as 'Marginal Maize Production Areas (MMPA)', and they require targeted approaches. It is important to identify MMPA with certain features in common that allow:

- Adaptability of common germplasm – CIMMYT and its partners need to identify the most suitable common germplasm to be used;
- Suitability of similar seed systems for release, production and sales of improved seed – CIMMYT needs to support its partners in developing such systems; and
- Common political and market structures – beyond the influence of CIMMYT and its partners.

If CIMMYT identifies such MMPAs, it can focus on finding the right solutions for making an impact on highly indigent areas. CIMMYT's strength is the immense value of its improved germplasm and genetic resources, and the availability of the best classical and modern tools to deliver results to areas where urgent help is most needed. The following analysis and recommendations are based on the assumption in CIMMYT's new strategy that CIMMYT's clients are living in marginal maize production areas.

In conclusion, the Panel found ample evidence from documentation and from its interaction with CIMMYT's partners that CIMMYT's maize breeding is widely recognised as having been generally of good quality and relevant for the recipient countries.

### **3.3 Natural Resources Group**

The Natural Resources Group (NRG) was small compared with other programs in CIMMYT, with the number of IRS varying around five, and not exceeding ten even when associated scientists were included. While natural resource issues have engaged CIMMYT scientists in other programs, particularly the Wheat Program, the review focuses on the work of the NRG. There had been no formal external review of the NRG before the recent restructuring of CIMMYT, and relatively little systematic information is available on the achievements of the group.

### **3.3.1 Outputs**

#### *3.3.1.1 Development of Conservation Agriculture*

Zero tillage is a common practice in the US and Brazil. The advantages of zero tillage have been examined in long-term experiments by CIMMYT scientists in Mexico where the technologies for conservation agriculture have been refined and then implemented in other countries. Conservation agriculture techniques were well developed in rice-wheat crop rotation systems in the Indo-Gangetic Plains (IGP). Zero tillage allowed planting of wheat directly to rice stubble which resulted in earlier wheat planting and consequently, higher yield.

A number of machines have been developed for conservation agriculture purposes to suit the needs of different regions. The availability of this machinery had a huge impact on the development and adoption of conservation agriculture. For example, sowing machinery helps reduce turnaround time from rice harvesting to wheat planting in the rice-wheat system. Hand held tractors and their accessories have helped intensification and diversification of agriculture in Bangladesh and Nepal. No-till animal traction small-grain drill was designed and produced in Bolivia, and was further developed by CIMMYT scientists for use in different countries, such as Nepal and Mozambique.

#### *3.3.1.2 Development of Second-generation Technologies*

The raised bed system was refined by CIMMYT scientists in Mexico in the early 1990s to allow establishment of permanent beds. The bed system was then combined with minimum tillage to take full advantage of the system. Cooperative bed planting projects have been conducted in several countries including Uzbekistan and Kazakhstan. In 2001, the Ludhiana Research Evaluation Committee approved raised beds with furrow irrigation as a technology for distribution in the Indian Punjab, thus extending the technology.

With minimum tillage, crop residue can be retained and this improves the soil's fertility and physical characteristics, and reduces soil erosion. The beds have a number of advantages over conventional tillage system; some studies indicate a 30 % reduction in production cost through more timely sowings and savings on seed cost; up to a 40% reduction in the amount of irrigation water used; fewer tractor passes with a saving in fuel cost and more efficient fertilizer use, less lodging and higher yields. Mechanical and manual weeding can be done more readily with raised bed, reducing herbicide use. In high rainfall areas with heavy soils, the use of beds minimizes water logging. Bed planting also reduces water use and prevents further reduction in underground water table.

Raised bed planting is also advantageous in terms of introducing rotation crops; for example, high value crops such as mungbean, potato, pulses and maize in Bangladesh and Pakistan. In Bangladesh, this crop option includes vegetable crops that may minimize the incidence of rickets. These crop options are being examined by farmers with CIMMYT and partner scientists in different countries.

In other examples of second generation technologies, 'permanent bed planting' can be used in which beds are not destroyed at crop maturity, allowing the crop residue to remain on the soil surface. Bed planters were developed to facilitate the new cropping systems in the South Asia region. The introduction of potatoes to South Asia was assisted by the development of potato planters suitable for the region.

The Rice-Wheat Consortium (RWC) is helping farmers plant different crops to increase incomes and household nutrition security. NARS researchers together with CIMMYT scientists are monitoring the effect of other resource conserving technologies (RCTs) on water saving. The RCTs being assessed are land leveling, zero tillage, bed planting wheat and other crops, direct seeded rice on raised beds and unpuddled flats with and without residues, and intercropping systems. Preliminary results show that (i) beds save water, and (ii) land leveling saves water and also improves water productivity. Adoption of direct seeded rice without soil puddling for the crop would reduce soil degradation.

#### *3.3.1.3 Value of Long-term Experiments*

Effects of zero tillage, residue management, and rotation may not show in the initial years of experiments, but may appear after several years, requiring a need for long-term experiments. This was the case in conservation agriculture experiments in Mexico, where CIMMYT has continued at three locations since 1991. A large number of maize/wheat rotation vs. continuous cropping tillage systems (conventional vs. zero till), and residue management systems (straw removed vs. retained) have been examined. Similar experiments are in progress in other countries. The benefit of zero tillage has been strongly demonstrated when residue is retained, particularly with maize. Maize appears more sensitive to these treatments while wheat is more robust with rather small variation in crop yield among different tillage and residue management treatments. Long-term experiments are excellent tools to develop and demonstrate new crop management systems, and CIMMYT's work has demonstrated this clearly.

#### *3.3.1.4 Use of GIS for Natural Resource Management*

A geographic information system (GIS) is widely used by CIMMYT scientists for NRM as well as in other areas. For example, while RCTs may be available that can be used to overcome crop production constraints and to maximize resource use efficiency; it is another matter to identify areas where the technologies can be utilized. Recent development of GIS helps identify areas where the technologies can be utilized successfully. This may be combined with remote sensing done several times in a year. Such work includes estimation of underutilized and problematic areas in a case study area in the Eastern Gangetic Plains. Underutilized and problematic land types identified include current fallows after the wet season rice, excessive moisture areas, waterlogged areas, salt affected areas and riverside areas, adding up to about 27 % of the total arable lands in the study area. It was estimated that early planting of wheat through zero tillage would be applicable in more than half of the underutilized area.

GIS technologies developed by CIMMYT have also been used for providing base line information, such as the development of country almanacs using an Almanac Characterization Tool. The almanacs are now available for a number of countries in Africa and Asia. The achievement here is that GIS has become simple to use and is readily available to many researchers and extension personnel. For example, in Bangladesh, the Bangladesh Country Almanac (BCA) was developed which contains information on climate, land, water and vegetation. This was then used for developing crop suitability maps and food insecurity maps. Training workshops reaching over 900 people were held on the use of BCA. BCA was

distributed widely throughout the country and used for different purposes such as identifying suitable soils and areas of drought risks for wheat cultivation.

#### 3.3.1.5 *Minimizing the Effect of Soil Fertility Decline in Sub-Saharan Africa*

Soil fertility decline has been identified as a significant problem in some arable lands in SSA which has old depleted topsoils in many areas. While long-term data on soil fertility decline are difficult to obtain; use of nitrogenous fertilizers has declined for the last 10 years or so reaching a level of less than 10 kg/ha in SSA, partly as a result of the high cost of fertilizer relative to crop yield, which is low due to other production constraints. CIMMYT has made comprehensive assessments of the financial viability of soil fertility options in southern Africa.

A number of methods have been found by CIMMYT scientists to prevent decline in soil fertility or to minimize its effect on crop production. Legumes can contribute to the nitrogen balance in the field and the fixed nitrogen can be subsequently used by maize and other crops, which reduces decline in soil N level and crop yield. For example, green manure (mucuna) was introduced into Malawi, and recommendation domains were defined. While crop rotation including a legume, such as maize-pigeon pea, may be successful in some areas, shortage of land, common among smallholders, limits the use of legume crops. Despite the fact that maize after legume may produce higher yield than continuous maize, low legume yields (e.g. groundnut in Zimbabwe) make the rotation involving legume unattractive in terms of financial returns. Similarly, while intercropping of maize-legume is often successful in southern and East Africa, a high proportion of legume component in the intercrop often results in reduction in the productivity of maize, resulting in lower profitability. In some cases relay-intercropping is more suitable than rotation of crops as it requires less time and land area compared to the rotation of two crops or intercropping, as it causes less competition between the component crops. For example sunhemp (*Crotalaria juncea* L.) and cowpea (*Vigna unguiculata* L.) can be successfully relay-intercropped with maize in Zimbabwe without penalty to maize yield under certain crop management conditions.

However, these crop management technologies are often site specific and season specific, particularly under unfavourable environments such as in SSA, and hence technology development and transfer require much more efforts than when developed for favourable conditions. There is a need for networking, and CIMMYT is engaged in SoilFertNet in southern Africa, ECAMAW in eastern and central Africa, and Soil Fertility Consortium established more recently for southern Africa. The networks have provided materials for potentially promising technologies that have been tested by farmers. The SoilFertNet produced a list of 'best bet' technologies for different countries, which it has vigorously promoted. The list includes technologies to increase soil fertility such as area specific N and P fertilizer recommendations and legume rotations, and fertility-enhancing cropping systems, e.g. pigeonpea/cowpea-maize-cassava rotation in coastal and central Mozambique.

#### 3.3.1.6 *Other Outputs*

There are a number of other NRM outputs from CIMMYT. Simulation modeling was actively promoted particularly in the early part of this review period, and CIMMYT developed a new method to combine simulation modeling with GIS, allowing spatial integration of simulation

results. New routines were developed to model phosphorous responses and residual effects within APSIM and DSSAT models.

Recognition of plant nutrient disorder, such as Zn deficiency in wheat in Turkey, is also a significant discovery. In collaboration with breeders, the NRM scientists identified the best germplasm for high Fe and Zn content in wheat grain. Calibration of NDVI sensor was done to commercially diagnose N deficiency in wheat.

The NRG published a total of 22 peer-reviewed publications during the review period (Table 3.3). The average, 0.4 publications per staff member annually has been rather low relative to other similar groups, but publishing rate seems to be increasing. Nearly all publications (91%) were done jointly with partners, mostly with institutions from the South.

**Table 3.3 – Natural Resources Group Publications and Staff (1999-2004)**

	1999	2000	2001	2002	2003	2004
All peer reviewed publications	3	0	2	7	7	3
Jointly with partners	2		2	6	7	3
In regional journals					2	
International staff	10	8	8	9	11	na
Peer-reviewed articles/staff	0.03	0	0.03	0.08	0.64	

### 3.3.2 Impacts

#### 3.3.2.1 Conservation Agriculture

Conservation agriculture has been promoted in many different countries. In Bolivia, permanent zero tillage had been adopted on some 300,000 ha by 2001. The NRG has had the most significant impact in the IGP where the RWC has provided technical support and information to farmers on conservation agriculture in rice-wheat double cropping. The area of direct seeding of wheat into rice paddies after rice harvest increased rapidly from 260 ha in 1997-98 to 560,000ha in 2002-03, 1,160,000 ha in 2003-04, and 3 million ha in 2004-05. Farmers are now in possession of more than 20,000 zero-tillage planters. Net benefits in India and Pakistan through higher yield and reduced production costs are estimated to have been more than US\$ 100 million in the winter of 2003 winter. This practice reduces tractor passes in the field and saves some 75 million liters of diesel.

While conservation agriculture has been adopted more in the north-western part of IGP where irrigation water is generally available for wheat, it has been now adopted in eastern IGP as one of RCTs. In the state of Bihar, around 1,700 farmers have adopted the new technology, and in Eastern Uttar Pradesh it was used by some 2,800 farmers and covers 45,000 ha. The technology is now spreading to areas of small farms (0.5-2 ha) where irrigation water may not be fully available.

In Bangladesh, some 2,600 farmers benefited directly from the Bangladesh Hand Tractor accessories applied to different crop production activities. Using these accessories, nearly 1,500 ha of land were planted to wheat, rice, maize and other crops in 2003-04. In 1998, 72 % of wheat growers reduced the turnaround time between crops by using hand tractors imported from China.

### 3.3.2.2 *Adoption of Raised Bed Systems*

The raised bed system developed in Mexico was rapidly introduced in other countries and is well accepted by farmers in different regions. In China, this technology was tested in Shandong Province in the Yellow River Basin recently, and over 26,000 ha are now planted on beds. This water saving technology is expected to expand rapidly in the Yellow River Basin particularly with rice, maize and wheat, as there is a shortage of irrigation water.

### 3.3.2.3 *Minimizing the Effect of Soil Fertility Decline in Sub-Sahara Africa*

While results of many experiments appear promising in maintaining soil fertility or increasing grain yield, technology adoption is generally poor in East and Central Africa. The External Review of the Africa Maize Stress Project (AMS) in 2001 brought up this issue. It states: '... there have been extensive studies of tied ridges in East and Central Africa, which have clearly demonstrated their agronomic benefits. The major problem in all the countries is lack of adoption for socio-economic reasons. The Review Team found little evidence of adequate *ex ante* evaluation of many of the agricultural experiments conducted. Consequently, results in many cases merely confirm well-known agronomic advantages of many of the treatments, but are not likely to produce technologies that are adoptable in the short to medium term. It is well known that legume fallows will significantly increase the yield of the following maize crop, as will poultry or farm yard manure! The problem is the economic returns to farmers in areas of labor or capital scarcity'. Perhaps the most significant impact of CIMMYT work in this area has been to raise awareness of the broad constraint that soil fertility imposes on maize-based cropping systems in Africa.

A few networks involving CIMMYT in Africa contributed to some adoption of technologies. The new Soil Fertility Consortium for southern Africa includes a number of NGOs and farmer associations and the best bet technologies are being thoroughly tested. With farmer participation, it is likely that technologies will be more readily adopted. One of the objectives of the Consortium is to focus on making field-level impacts on crop and soil management and outcomes are expected within a few years.

### 3.3.3 **Assessment**

CIMMYT has made excellent achievements in NRM in the last several years, particularly in the area of conservation agriculture in Asia. CIMMYT's applied research in NRM in the last several years concentrated on development of conservation agriculture practices: zero tillage, crop rotation and raised beds that reduced soil degradation and water use and increase productivity. These practices provide a unifying theme for CIMMYT's NRM research in the wheat and maize-based cropping system. The major achievement in this review period has been wide adoption of these technologies. This was the result of collaboration with many partners in CGIAR Centers (IRRI in particular) and other organizations. Thus NRM accelerated technology transfer, and assisted site specific technology development. This was particularly the case in the rice-wheat system in the IGP. The RWC received the CGIAR King Baudouin Award for promoting conservation agriculture that benefits large numbers of farmers in the IGP of South Asia

CIMMYT has made significant contribution to the RWC. The RWC is driven by NARS, but it operates as an inter-institutional and inter-center multidisciplinary network facilitating

systems-based farmer participatory research in the rice-wheat cropping system of the IGP. As the convening Center, it has successfully developed a culture of collaboration for many partners in the Consortium. External review of the RWC, commissioned by CIMMYT at the request of the Regional Steering Committee of the RWC, concluded that the RWC had been a successful innovation serving as a model for regional and international cooperation with a credible record of achievements. The Panel endorses this view.

Success in NRM research and development in CIMMYT has commonly followed a particular pattern: young scientists come to Mexico from Turkey and China, for example, to study (short course, e.g. 1 month), learn practical aspects of conservation agriculture, and then they develop technology in their home countries to suit their physical and socio-economical environments, with the assistance of CIMMYT scientists. This is also the case for Mexico itself where some 15 students were trained in the last 20 years or so in NRM, but not in recent years. It is suggested that CIMMYT ensure that a new generation of agronomists in partner countries is given the opportunity to be trained by senior CIMMYT scientists (Section 7.4).

#### *3.3.3.1 Resource Saving - Water use Research*

Although applied research in conservation agriculture has been excellent and the technology is well adopted by farmers particularly in Asia, strategic research is required to understand resource use efficiency. For example, data on the impact of raised bed system on water saving and raising the water table do not appear available. Similarly the overall impact of plot level technology on total water use at the basin level is yet to be determined.

This issue of lack of strategic research was documented in detail in the 4<sup>th</sup> EPMR. The report states 'Adoption of conservation tillage and improved residue management will alter nutrient cycling rates and processes, water relations, weed species, and disease and insect pressure. The magnitude of these changes and their interactions in tropical and subtropical environments, however, will be fundamentally different from those found in temperate regions. Strategic research is required to better understand these processes. This knowledge will facilitate applied and adaptive research by identifying key parameters to measure and appropriate environments for conducting on-farm research, and opportunities for modifying other management practices to fully exploit the benefits of conservation tillage systems'. The same statement can be made at this point in time.

#### *3.3.3.2 Wheat vs. Maize NRM*

As indicated above, the excellent work by CIMMYT scientists in NRM in wheat agronomy has had tremendous impact on recent agricultural development, particularly in Asia. Impact in maize based cropping system is however much less than that in cropping systems that involve wheat. This is at least partly related to the smaller resources available to the maize NRM compared with the wheat NRM in CIMMYT.

### **3.4 Economics Program**

#### **3.4.1 Introduction**

CIMMYT's Economics Program was discontinued in January 2004. The Impact Targeting and Assessment Program (ITA) took over most of the activities of the Economics Program, with

the disciplinary support of the Social Sciences Group (SSG), which also has the mandate to generate specialized inputs for the other five new research programs. In the sections that follow, the evolution, performance and achievements of the Economics Program will be reviewed.

#### **3.4.2 The Role of Social Sciences in the CGIAR**

Four major roles can be identified for social scientists working in the CGIAR Centers: 1) Ex post impact assessment: to gauge the efficacy of CIMMYT's work and to estimate the social rate of return (or the benefit-cost ratio or the net present value) of investments made by donors in CIMMYT programs; 2) Ex ante impact assessment: to provide valuable information for the strategic planning process and monitoring of its implementation and as a tool for priority setting and research resource allocation; 3) Studies on adoption paths and constraints to adoption of improved technology by farmers; 4) Agricultural and macroeconomic policy analysis: to assist management in the assessment of critical variables and processes outside of the control of the institute that might affect (positively or negatively) the outcome of its intervention strategies.

#### **3.4.3 Staffing and Budgeting**

The number of IRS seems to have remained relatively stable from 1999 to 2004, with a drop from 12 economist in 1999 to the current 8, and 2 non-economist social scientists throughout the period. This is still far from the 1992 peak (25 social scientists, 23 of them economists).

In the last years the Economics Program budget was reduced from approximately US\$ 2 million in 1999 to about US\$ 1.7 million in 2003, with nearly all the cut in unrestricted funding. In 2000, the Economics Program peaked in terms of staff and budget after which the program size has been reduced.

#### **3.4.4 Outputs**

The Economics Program has been involved in three projects during the period 1999-2003:

- Global Project 7: Gauging the Productivity, Equity and Environmental Impact of Modern Maize and Wheat Production Systems (from 2001 Project 7: Impacts of maize and wheat research).
- Frontier Project 4: Improving Human Nutrition by Enhancing Bio-available Protein and Micronutrient Concentration in Maize, Wheat and Triticale (from 2001 Project 19: Biofortified Grain for Human Health; later HarvestPlus CP).
- Frontier Project 6: Priority Setting and Technology Forecasting for Increased Research Efficiency (from 2001 Project 21: Technology Assessment for Poverty Reduction and Sustainable Resource Use).

To facilitate the assessment of their relevance, the outputs (peer-reviewed papers and CIMMYT publications, excluding drafts and internal working papers) for the period under review were classified into the following categories:

1. Impact (Global; Regional; National; Local/case studies)
2. Adoption and constraints to adoption
3. Participatory research
4. Priority Setting
5. Policy Analysis

6. Prospective Analysis
7. Other

Table 3.4 shows the Economics Program outputs as peer-reviewed journal articles and non-peer reviews publications (CIMMYT publications, including books).

**Table 3.4 – Economics Program: Outputs 1999-2004 (Peer-reviewed/non-peer reviewed publications)**

Year	Impact				Adoption	Particip. research	Priority setting	Policy analysis	Prospect. analysis	Other
	Global	Regional	National	Local						
1999	0/0	1/0	0/0	0/0	0/4	0/0	0/0	1/1	0/3	1/7
2000	1/0	0/1	0/0	0/0	1/1	2/1	1/0	0/0	0/0	2/1
2001	½	0/2	0/1	0/0	2/1	1/1	0/0	0/2	0/0	3/1
2002	0/2	0/0	0/2	0/0	0/0	0/2	0/0	0/0	0/0	5/1
2003	2/0	0/0	0/0	0/0	2/2	2/0	0/0	0/0	0/0	9/6
2004	0/0	0/0	0/0	0/0	0/4	1/0	0/4	1/0	0/0	2/0
<b>Total</b>	<b>4/4</b>	<b>1/3</b>	<b>0/3</b>	<b>0/0</b>	<b>5/12</b>	<b>6/4</b>	<b>1/4</b>	<b>2/3</b>	<b>0/3</b>	<b>22/16</b>

A total of 40 of peer-reviewed publications were made by IRS Economics Program staff over the 1999-2004 period, averaging 0.6 peer reviewed publications per year (1999-2004). Twenty three of them were published jointly with partners predominantly from the North.

The Panel reviewed a sample of these publications and concluded that the academic level and relevance has been excellent.

From the analysis of the publications, there appears to be a significant concentration of program resources in three themes: adoption-constraints studies (17 publications), *ex post* impact studies at the global, regional and national levels (8, 4 and 3 publications, respectively), and participatory research (10 publications). No publications dealing with impacts at the local level were found. The Panel was surprised to learn that no *ex ante* impact studies were found among the list of publications made available to it.

As reflected by the kinds of publications CIMMYT's Economics Program has published, there has been lack of attention to policy analysis (the theme of Project Global 7) and prospective studies, where very little has been published.

### 3.4.5 Assessment

The Panel's overall assessment of CIMMYT's Economics Program is that it has been, within the organizational structure that was in place until 2004, highly effective in two of the four roles identified above, generating outputs and providing services to the other programs, in most instances with the participation of national research institutions in the subject matters of: i) *Ex post* impact assessment, at the national, regional and global levels; ii) Studies on highly location-specific technology adoption paths and constrains to the adoption of improved technology.

The 4<sup>th</sup> EPMR of CIMMYT made three recommendations with respect to the Economics Program. Addressing Recommendation 13, the Panel believes that the Economics Program has strengthened over the period of time under consideration, its presence in Asia, judging by the most recent CIMMYT publications on production systems, constraints and research priorities in Indonesia, The Philippines, Thailand and Vietnam, all of them written with the participation of or exclusively by staff affiliated with NARS, Ministries of Agriculture and universities. The methodological tools used in these studies was developed at CIMMYT and they provide a substantial amount of relevant information about production functions in selected agroecological regions and constraints to adoption of improved technology.

The Panel found no documented evidence that CIMMYT has addressed Recommendation 12 of the 4<sup>th</sup> EPMR on the need to make, in discussions with the RCC, a determination as to a balance of the Economics Programs' institution-wide activities, research activities, support to other programs, support to NARS and its own frontier research.

With respect to Recommendation 14, on the need for a gradual increase in emphasis on macroeconomic policy analysis of selected countries, the Panel has noticed that the publications on that particular subject have been surprisingly few and wide apart during the period under consideration.

On the other hand, the Panel acknowledges that, with the establishment of the SSG in 2004, CIMMYT has in a way addressed effectively a suggestion made by the 4<sup>th</sup> EPMR regarding the need to introduce changes in both the disciplinary composition and the denomination of the Economics Program.

The Panel could not find any documented evidence of the Economics Program having conducted, as suggested by the 4<sup>th</sup> EPMR, a priority-setting exercise for its own work.

As far as the outreach-based SSG staff, the Panel was able to confirm, on the ground, during a field visit to Mozambique, Zimbabwe and Kenya, the commitment of the social scientists, as well as the efficacy, high quality and relevance of their work in SSA, regarding research associated with and services provided to the African Livelihoods Program (ALP), as well as capacity building in social sciences and networking. A great deal of effort is currently underway, with the support of the SSG based in El Batan, to make progress in developing methodologies to conduct impact studies using the Sustainable Livelihood Approach. However, the Panel is concerned with the fact that the complexity of the approach itself will make it difficult for the ALP and the other Eco-Regional Programs to have *ex post* impact studies implemented by the time the current MTP is completed, since the necessary baselines that must include the new indicators (which are in the process of being selected and defined), are still under construction and will be for quite some time before they can become operational as benchmarks for the assessment of CIMMYT's work.

### **3.5 Applied Biotechnology Center**

The ABC was established in 1990 and elevated to full program status in 1995. It served two functions in the CIMMYT until its discontinuation in 2004. First, it provided molecular marker services to the other programs particularly to the wheat and maize breeding

programs and the Genetic Resources Center. Second, it initiated and conducted independent research on biotechnology in wheat and maize. The ABC was largely supported by special project funds with less than 10% unrestricted funding in recent years.

### 3.5.1 Outputs

- Reliable and efficient transformation technologies in bread wheat, durum wheat and maize. The ABC, in partnership with the Cooperative Research Center for Molecular Plant Breeding, has achieved a significant advance in improving both the level and reliability of transformation of specific wheat genotypes using biolistic bombardment-based transformation technology.
- Development of over 19,000 transgenic wheat lines carrying genes related to biotic and abiotic stresses.
- Enhanced capacity to routinely screen for molecular markers to facilitate MAS in both wheat and maize. The current capacity of the laboratory is about 60000 assays per year and is expected to increase significantly in the foreseeable future.
- Development and application of MAS systems in maize for QPM and Maize Streak Virus which facilitates the transfer of these traits to a wide range of maize germplasm.
- Development and application of MAS systems in wheat for a range of traits including disease resistance, phasic development, physiological characters and quality traits.
- Development of a new strategy for the use of MAS in breeding programs-Single Large Scale MAS.
- Development of large scale fingerprinting technology for maize and a bulk fingerprinting method for heterogeneous populations.
- Diversity analyses in maize in association with the breeding programs to better understand the occurrence of heterosis within the existing breeding crosses, populations, synthetics and inbreds with the aim of developing better technologies for hybrid prediction and better ways to generate superior synthetics and new modern maize varieties.
- Development and complete characterisation of 9 transgenic wheat lines with various *Cry* genes for insect resistance.
- Isolation and characterisation of genes related to the reproductive pathway of maize that may be related to apomictic development.
- Development of protocols to allow for the first field testing of transgenic wheat in Mexico.

**Table 3.5 – Biotechnology program publications and staff for 1999-2004**

	1999	2000	2001	2002	2003	2004
All peer reviewed publications	12	4	9	13	12	15
Jointly with partners	10	3	7	8	11	8
In regional journals	1	3	1		1	
International staff	22	19	17	15	15	na
Peer-reviewed articles/staff	0.5	0.2	0.5	0.7	0.8	

The Biotechnology Group produced some 65 peer reviewed publications during 1999-2004 (Table 3.5), on average 0.6 per researcher annually (1999-2003). Of these publications, 47 were done jointly with partners involving institutions both in the North and the South. The Group also produced 11 other publications.

### 3.5.2 Impacts

The Biotechnology Group is primarily a research and services group that generates intermediate products, principally aimed at improving the effectiveness and efficiency of CIMMYT's breeding and pathology programs, rather than products that impact directly on the poor. Their success can be judged by the fact that the demand for their products by other groups in CIMMYT greatly exceeds their capacity to supply them. In addition, they have a number of developments in the pipeline that are likely to impact significantly on CIMMYT's breeding programs. These include new tools to identify highly heterotic combinations in maize which should improve the efficiency of the breeding process by helping to reduce the number of hybrid combinations that need to be made, and reduce the time taken to identify potential commercial varieties. They also include an increasing number of molecular markers for QTL's controlling stress tolerance, particularly drought tolerance, in both wheat and maize.

### 3.5.3 Assessment

The Biotechnology Group provides CIMMYT scientists with a strong base and support in modern molecular genetic technologies including molecular marker development and validation in both wheat and maize, identification of QTLs for priority traits in the breeding programs, tissue culture and transformation technologies, and bioinformatics. It has been a highly successful program that has attracted, and continues to attract, additional donor support to the Center. The ABC prior to its closure established a high throughput service laboratory to provide molecular marker services to the wheat and maize breeding programs. This unit which was originally housed within the ABC provides in-house services such as DNA extraction, mapping and marker assay work on a routine basis. About 60,000 assays are performed in the service laboratory per annum. The Panel congratulates the former ABC on this initiative. However, it is clear that the demand for marker services in the breeding programs will quickly exceed the current capacity of the service laboratory. Hence there is an ongoing need to increase the capacity of the laboratory to meet breeders' needs.

There have been no CCERs of the ABC since its establishment. However, because of its strong portfolio of special projects there have been a significant number of donor reviews. The EPMR did not have access to these reviews as they are usually confidential with the donor. If special projects continue to be a major component of the research portfolio of most Centers, and there is little evidence of this changing, the Panel **suggests** that reviews by donors need to become a routine input into the EPMR.

## 4 THE NEW RESEARCH PROGRAM

### 4.1 Introduction

CIMMYT's new research structure has six broad thematic Programs, two global and four eco-regional, designed to catalyze interdisciplinary research in collaboration with a wide range of partners including ARIs, NARIs, NGOs, private companies, and other CGIAR Centers. These six Programs will interact with Groups representing expertise in scientific disciplines. In this new matrix structure, the Programs are the vehicles to deliver outputs and impact, and the disciplinary Groups role is to ensure a critical mass of expertise in key areas and continuing scientific excellence.

At the time of the EPMP the new Program had only been effectively functioning for 10 months and several of the newly appointed Program Directors had just taken up their posts. In reality the new program structure was a work in progress and is likely to remain such for some time. Hence it was not possible to assess the capacity of the new Program to deliver their planned outputs and impacts. Rather in this Chapter the Panel critically assesses progress towards implementation of the new program structure, in particular, the new elements of each Program.

### 4.2 Genetic Resources

The Genetic Resources Program (GRP) is one of the two global Programs in the new structure. The globally important collection of genetic resources of wheat and maize held in trust by CIMMYT is regarded by the Center and its stakeholders as one of its primary assets. This Program supports the Center's ethical and legal commitment to the long term conservation and guaranteed availability as public goods of the genetic resources it holds. It also provides the vehicle for the Center with its partners to characterize and use those resources to improve germplasm targeted to smallholder farmers. The Program contains CIMMYT's biotechnology research.

#### 4.2.1 Objectives and Priority Setting

The theme of GRP is the harnessing of maize and wheat genetic diversity for humanity. Its broad objective is to enhance the productivity, nutritional quality, profitability and stability of wheat and maize varieties used for food and feed through the targeted use of global genetic resources.

The Program has three specific objectives each with a number of components:

**Objective 1:** Global custodianship, characterization and management of the genetic resources of maize, wheat and related species

**Components:**

1. Improvement of collections held in trust through acquisition of key related species and genetic materials of maize and wheat
2. Inventory of entire wheat collection checking quantity, viability and data quality
3. Characterization of maize and wheat genetic resources for key traits

4. Development of web-based genebank information, management and distribution system
5. Development and application of statistical and simulation models for efficient maintenance and use of maize and wheat genetic resources
6. Development of strategies for on-farm management of genetic resources

Fifty percent (50%) of the Program's resources will be targeted at this objective in 2004. However, this figure is expected to drop to forty percent (40%) by 2009 as work on the genebank management and bioinformatics systems is completed and fully implemented.

**Objective 2:** Enhanced utilization of genetic resources globally

**Components:**

1. Development of maize and wheat consensus maps for tolerance/resistance to abiotic and biotic stresses, and enhanced grain nutrition
2. Identification of genes, alleles and biological pathways involved in tolerance to abiotic and biotic stresses, enhanced grain quality, and asexual reproduction (apomixis)
3. Development of bioinformatics platform for handling and analyzing genomic data
4. Development of useful maize and wheat germplasm with enhanced tolerance to abiotic and biotic stresses and enhanced grain quality
5. Improved MAS strategies for use by CIMMYT and its partners
6. Production of genetically engineered wheat and maize lines carrying key genes for deployment to CIMMYT partners

Forty percent (40%) of the Program's resources will be targeted at this objective in 2004. This is expected to rise to forty five percent (45%) in 2009 with increased emphasis on trait and gene discovery and germplasm development.

**Objective 3:** Enhanced capacity in genetic resource management maintenance and use in CIMMYT and its NARS partners

**Components:**

1. Facilitation of improved capacity by CIMMYT's partners for storage and management of genetic resources
2. Increased use of genomic approaches by CIMMYT and its partners in germplasm characterization, gene discovery and germplasm development

Ten (10%) percent of the Program's resources will be devoted to capacity building in 2004 rising to fifteen percent (15%) in 2009.

Priority setting for this Program was initially carried out as part of the extensive consultations undertaken in 2002/2003 for the new CIMMYT strategic plan and also in the formulation of the complementary strategy for the Genetic Resources and HarvestPlus CP to which it contributes. No economic studies are available to underpin the priority setting process or to identify priority traits for germplasm enhancement and gene discovery projects. A major priority setting exercise to refine the priorities for the 2005 -2007+ MTP was conducted during a GRP meeting held in Mexico in September 2004.

#### **4.2.2 Program Structure**

At the end of 2004, 20 scientists were involved in the Program contributing the equivalent of 17.5 person years of full time equivalents (FTEs). The distribution was 5.5, 10.5, and 1.5 FTEs respectively in Objectives 1, 2, and 3.

*Pre-existing Elements* - The Program contains several major ongoing activities at CIMMYT. These include the operation of the Wellhausen-Anderson Plant Genetic Resources Center which covers the conservation, documentation and regeneration of the accessions held in trust by CIMMYT; the screening of genetic resource collections for traits of interest to CIMMYT and NARS maize and wheat improvement Program; management of intellectual property associated with genetic resources; wide-crossing and pre-breeding activities; and on-farm management of traditional varieties.

*New Elements* - GRP contributes to two CGIAR Challenge Programs - Genetic Resources (Generation CP) and HarvestPlus - and most of these activities are new although they complement ongoing CIMMYT activities. For example, under the Generation CP, CIMMYT has new projects on genetic diversity, comparative genomics and gene transfer, although these were already strong areas at CIMMYT.

#### **4.2.3 Expected Projected Outputs and Impacts**

By 2007 GRP expects to achieve outputs in the following areas: Global genetic resources networks involving most of the maize and wheat genebanks established and operating; Enhanced collections of wheat, maize and their near relatives, particularly from Latin America, Africa and Asia, and cytogenetic stocks in wheat; Complete inventory of CIMMYT wheat genetic stocks; Characterization of wheat and maize accessions at phenotypic or molecular levels; Globally accessible web-based genebank information, management and distribution system implemented; Strategies for efficient genebank management; Information on gene-flow in farmers fields; Consensus maps for drought tolerance and insect resistance in Maize and drought tolerance and Fusarium resistance in wheat; Genes, alleles and pathways for improving a range of biotic and abiotic stress tolerances in maize and wheat; DNA samples from genetic resource accessions for use in structural and functional genomic studies; Bioinformatics platform; New synthetic or bridge wheats from A, B and D genomes; Increased use of MAS in wheat and maize and double haploids in wheat; Transgenic maize and wheat lines with required regulatory information for transfer to NARS partners; and Training in genetic resources conservation and use.

Impacts are projected both in improved gene-bank operation and genetic resource use. The Program expects to develop an integrated CIMMYT genebank covering both wheat and maize with a more comprehensive, fully documented and conserved set of accessions and to establish strong working linkages to wheat and maize genebanks in both developing and developed countries as part of a global network. Key maize and wheat accessions are to be characterised. The Program aims at enhancing the understanding of the genetic basis of tolerance to a range of biotic and abiotic stresses and developing effective strategies for on-farm conservation and on-going management of traditional varieties. Both molecular and conventional pre-breeding technologies will be developed and used to facilitate the transfer of desirable traits from genebank accessions to elite germplasm. A comprehensive data

management system which enables global web-based access to information on genetic resources.

#### 4.2.4 Assessment

This is an exciting and ambitious Program that builds effectively on the pre-existing activities in genetic resources at CIMMYT. The Panel commends CIMMYT for its continued leadership role in this area, and for its strong commitment to the conservation and use of wheat and maize genetic resources. It is pleased to see that this Program seeks to build global wheat and maize global genetic resources networks with partners in both developed and developing countries. The Panel is also pleased to see that the new Program seeks to rectify a number of shortcomings of the pre-existing activities in this area. In particular, the Panel notes:

- Amalgamation of the formerly separate wheat and maize collections into one integrated unit. The existence of separate genebanks is historical and relates to the time when they were part of separate wheat and maize programs at the Center. Successive reviews have called for the integration of the activities into a cohesive, unified and efficient program. Until now CIMMYT has failed to fully grasp the nettle. The benefits of a single program would not only be financial but also political. It is hard for CIMMYT to argue globally for greater co-operation amongst genebanks of smaller developing countries, or among the genebanks of Future Harvest Centers, if it cannot demonstrate such cooperation in house.
- The development of a comprehensive data base management system for the integrated genebank to enable global web-based access. In the past, CIMMYT was at the forefront in this area with the development of IWIS (International Wheat Information System) and involved in the transformation of that system into ICIS by a consortium of CGIAR Centers. It withdrew from this activity in 2002/03. The Panel notes that CIMMYT is formally investigating the adoption and implementation of ICIS which, if it were accepted, would bring CIMMYT in line with several other Centers including IRRI. The Panel strongly supports this decision. (For recommendation see Chapter 5.)
- Completion of the inventory of the entire wheat collection held by CIMMYT checking seed quantity and viability, and data quality. The wheat collection at CIMMYT has been poorly managed for a number of years and a significant backlog has built up in two areas: seed increase and entry of information into the IWIS database. Again the Panel commends CIMMYT for its commitment to rectify these ongoing problems.
- Greater emphasis on maize pre-breeding through development of a breeder's core subset of tropical and subtropical lowland accessions based on field evaluation data. Pre-breeding will broaden the genetic base of the CIMMYT maize genebanks for tropical, subtropical and tropical highland climatic conditions.
- More targeted research in maize on in situ on-farm conservation to enhance farmers' varieties. Such work has started by analyzing the intra-racial diversity of the race complexes that are being cultivated by farmers today. The best accessions representing the racial diversity and characteristics required by farmers should be reconstituted and efficiently used. This is an attractive approach to improve in situ farmers' seed and enhance production.
- A commitment to molecular characterization of the wheat and maize accessions it holds in trust using molecular markers on a priority basis. However, the Panel was of the view that CIMMYT needed to greatly enhance its capacity in high throughput marker technology, either through investment in new technologies or greatly increased

investment in established technologies. Unless it does this in the very near future, it will not be able to meet the demands for these services from the genetic resources and breeding research and hence its own Programs. CIMMYT will also have to review its need for capacity in bioinformatics, particularly in terms of operational resources.

The Panel noted that the use of molecular markers in maize breeding is lagging behind that in wheat breeding. This is surprising given the high use of molecular markers in private maize breeding program. The Panel therefore strongly **suggests** that CIMMYT should establish a working group composed of researchers from the Biotechnology Group and maize breeding to ensure faster application and efficient use of molecular markers in maize breeding.

The Panel also noted CIMMYT's commitment to the prevention of the unintended presence of transgenic materials (GMOs) within its genebank accessions through rigorous gene bank management and congratulates the Center on its comprehensive efforts in this area.

### **4.3 Impacts Targeting and Assessment**

Most of the staff and the activities conducted by the Economics Program were transferred to Program 2, Impacts Targeting and Assessment (ITA), at the beginning of 2004. The economists and other social scientists, previously in the Economics Program, and the newly recruited ITA staff, also belong to the Social Sciences Group, which has been assigned the task of providing inputs for the ITA.

#### **4.3.1 Objectives and Priority Setting**

The overall goal of Program 2 is to increase CIMMYT's impact on improving the livelihoods of poor maize and wheat producers and consumers in the developing world.

The program has five specific objectives. Following a priority setting exercise, the objectives were prioritized according to their expected contribution to the achievement of the overall goal of the program. This did not involve an ex ante analysis, and the criteria for the assignment of weights were of an ad hoc nature. The objectives and their relative share of resources are the following:

- Objective 1 (20%): CIMMYT will strongly orient its work towards poverty reduction and will take into consideration the role of wheat and maize in cropping systems and livelihoods.
- Objective 2 (25%): CIMMYT's work is carried out efficiently and effectively using "best practices" (optimal mix of tried-and-true methods and cutting edge methods).
- Objective 3 (30%): Impact of CIMMYT's work is rigorously documented and effectively communicated.
- Objective 4 (10%): Policy implications inform policy debates and are used by policy makers in decision-making.
- Objective 5 (15%): CIMMYT knowledge and information enhance the capacity of partners and stakeholders.

The three thrusts of the Program are: targeting technology to poverty reduction; utilization of maize and wheat diversity; and role of quality in product markets and nutrition.

### **4.3.2 Program Structure**

As of February 2005, 15 IRS staff is involved in the program, which has 9.7 FTE in total. Eleven staff members, including the Program Director, are based in Mexico. Six allocate 100% of their time to ITA (4 others allocated between 20 and 40% of time to the program). The 4 outreach staff allocate between 20 and 30% to the program. There are two IRS staff in Zimbabwe, one in Kenya and one in India. Considering that all ITA staff, with the exception of the Training Coordinator, are also in the SSG, the Panel **suggests** that all ITA social scientists, not only those nominated as focal points, should allocate some time to other programs, to prevent cocooning.

**Pre-existing Elements** - ITA continues with adoption, ex post impact and sustainable livelihood approach studies.

**New Elements** - Greater emphasis is placed on poverty analysis, including the development of various types of databases containing socioeconomic and other data with information on maize and wheat sectors (to provide general context for poverty and livelihoods).

### **4.3.3 Projected Outputs**

By 2007 ITA expects to have outputs in the following areas: Generate knowledge to enable better understanding of causes and symptoms of poverty and of the livelihood strategies of the poor, to enable better understanding of the role played by maize and wheat in the livelihood strategies of the poor, and to understand the potential of improved maize and wheat technologies to provide pathways out of poverty; Improved knowledge of poverty and livelihoods for targeting and research priority setting at CIMMYT; Identify Best practices and methodologies, and modify and use current practices and methodologies modified as appropriate; Document and synthesize adoption of improved technologies and impacts attributable to technology adoption; Analyze policy implications relevant to CIMMYT mission drawn from CIMMYT and partner research; Synthesize CIMMYT information and knowledge and make it accessible; and Enhance partners' capacity for maize and wheat related research.

The Training Coordinator allocates 100% of his time to ITA which seems inconsistent with his Center wide role and activities. (See Chapter 7 for section on training)

### **4.3.4 Assessment**

The Panel commends CIMMYT for the new orientation, since the lack of reliable information about the significant differences between agroecological regions in one country has made it very difficult to construct baselines and conduct rigorous and comparable ex ante impact studies of technology adoption. One dimension seems to be missing, though: that of the differences in productivity not attributable to agroecological factors. The Panel acknowledges that CIMMYT's most recent research includes, in cooperation with local partners, the estimation of maximum, minimum and average yield data for selected agroecological regions, but a more precise picture of the technological situation would be of great help both in research priority setting and policy formulation.

***The Panel recommends that ITA, in cooperation with the ecoregional programs, collect data on the variables that explain the heterogeneity of the existing production functions and thus, of yields (both potential and actual) that express differences attributable to productivity gaps within the same agroecological region, due to constraints that limit the adoption of improved technology.***

The ITA logframe also includes ex ante impact studies, “best practices” activities and policy analysis. Regarding the last subject, The 4th EPMR recommended that the Economics Program; *in view of the increasing importance of macroeconomic policies as they affect maize and wheat, gradually place more emphasis on this aspect of research focusing on a few selected countries.* During the Panel’s field trip to three countries in southern Africa (Mozambique, Zimbabwe and Kenya), it became evident that, in all three cases, the single most important constraint to the adoption of improved technology by poor farmers is associated with agricultural and/or macroeconomic policy issues. Should the national political winds shift direction, it would be extremely valuable to have readily available to the national governments the results and policy recommendations of those studies as soon as the demand arises. This could make a great deal of difference in the prospects for reducing the time span required to realize improvements in poor farmers’ livelihoods.

***The Panel recommends that ITA initiate macroeconomic studies by 2006 in close cooperation with IFPRI and other CGIAR Centers. The highest priority should be assigned to sub-Saharan African countries.***

*Ex ante* impact assessment studies cannot be successfully designed and carried out without the effective contribution of breeders, resource conservation, crop management and others specialists, for instance, in the construction of baselines and the identification and description of technology impact pathways.

To facilitate the establishment of a multidisciplinary approach to conducting ex ante impact studies, ***the Panel recommends that increased integration through time allocation be secured between ITA staff and non-social scientists in the other programs.***

There is need to improve the Program’s work plan from the current MTP logframe. The ITA goal is to increase CIMMYT’s impact, but neither verifiable indicators nor means of verification are listed to enable independent assessment studies to monitor the achievement of this goal. As no quantification is attempted there is no way to define a baseline for “livelihoods of poor maize and wheat producers and consumers”, the magnitude of the “help” the program would provide or the size of its end-result, the increase in CIMMYT’s impact. The Panel also notes that the relevant assumption associated with this goal, *Current focus on poverty and livelihoods maintained*, is an internal matter of the Center.

Objective 1 does not have an associated baseline either, and in fact it would be very hard to construct one. Therefore, no impact can be measured, *ex ante* or *ex post*. The verifiable indicator included in the logframe is of little use: *CIMMYT resources allocated in pro poor fashion; CIMMYT outputs useful to the poor and jointly developed with appropriate partners.*

Similar observations can be made about all the 5 specific objectives included in the Program's logframe. Therefore, the Panel **suggests** that ITA revisits the entire logframe structure and content to ensure that the necessary adjustments are introduced to overcome its present limitations.

#### **4.4 Sustaining African Livelihoods**

##### **4.4.1 Introduction**

This new Program covers the most critical and resource poorest region in the world. SSA as defined by the World Bank covers all African countries excluding Morocco, Algeria, Tunisia, Libya, and Egypt. Some 700 million people or about 11% of the global population live in the region. The per capita annual income, according to World Bank figures had a negative growth of -11.9% from 1975 to 2003 and was only US\$ 1,618 in 2003, while the per capita annual income increased, for example, in the CWANA region by 13% in the same period (to US\$ 5,097) and in China by 68% (to US\$ 4,344).

Maize is the most important food crop in SSA, accounting for more than 50% of the total caloric consumption as food and feed (FAOSTAT 2004). The total maize acreage in SSA in 2003 reached almost 30 million ha, including an estimated 4 million ha maize for forage and fresh food (not published in FAOSTAT). For the 26 million ha of maize grown for grain, yield per ha in 2003 ranged from the lowest of 1q (Botswana) to 25q in Cameroon and 29q in South Africa. The overall average yield/ha was only 12.3q (see Table 4.1).

There are 33 countries in SSA, each producing more than 50 000 ha of maize. Over the last 10 years 15 countries had no increase in yield/ha or a negative increase. Only 10 countries showed an annual increase rate of above 2%, but the yields are generally still at very low levels.

In comparison, major maize producing countries in the tropical to subtropical regions of Asia and South America reached average grain yield of over 30q/ha in 2003 (Indonesia and Vietnam 32 q/ha; Thailand and Brazil 37 q/ha). China has already reached 48q/ha and grain yields in some major maize growing countries in the temperate world reached 80 to 90q/ha in 2003. These figures reflect the contribution of breeding and improved seed in these countries. Efforts in SSA need to be substantially increased in order to achieve similar sustainable long term results.

**Table 4.1 – Production of Maize in Sub-Saharan Africa (1993-2003)**

Country	Ha in 2003	Trend	Yield q/ha	Production in q	Changes in last 10 years
Angola	984,000	slight decrease	6.0	5,904,000	100%
Benin	754,900	+53%	12.0	9,058,210	20%
Botswana	84,000	4x	1.0	84,000	0%
Burkina Faso	435,000	+120%	17.0	7,395,000	21%
Burundi	116,000	-	11.0	1,276,000	-21%
Cameroon	300,000	-30%	25.0	7,500,000	120%
Cape Verde	50,000	+50%	2.0	100,000	-38%
C. African Rep.	116,000	+80%	10.3	1,194,800	13%
Chad	130,000	+80%	9.2	1,196,000	10%
Cote d'Ivoire	690,000	+4%	9.1	6,279,000	17%
Ghana	791,900	+24%	16.3	12,907,970	8%
Ethiopia	1,600,000	+90%	18.8	30,080,000	8%
Kenya	1,500,000	+15%	15.3	22,950,000	-4%
Lesotho	180,000	+74%	8.3	1,494,000	-6%
Madagascar	195,900	+6%	9.3	1,821,870	3%
Malawi	1,550,000	+17%	12.8	19,840,000	-16%
Mali	365,000	_42%	10.0	3,650,000	-9%
Mozambique	1,300,000	+54%	9.6	12,480,000	50%
Namibia	23,000	-30%	14.3	328,900	85%
Nigeria	4,700,000	-11%	11.0	51,700,000	-8%
Rwanda	102,800	+100%	7.7	791,560	-56%
Senegal	175,600	_61%	22.8	4,003,110	80%
South Africa	3,350,000	-23%	29.0	97,150,000	27%
Sudan	80,000	-	7.5	600,000	52%
Swaziland	60,000	-	11.7	702,000	-15%
Tanzania	1,580,000	-13%	15.4	24,332,000	23%
Togo	449,000	+32%	11.5	5,163,500	-1%
Uganda	670,000	-33%	17.9	11,993,000	12%
Congo D.R.	1,450,000	+6%	8.0	11,600,000	-4%
Zambia	750,000	+18%	15.5	11,625,000	-38%
Zimbabwe	1,387,000	+12%	5.9	8,183,300	-63%
Total	25,920,100			373,383,220	
Average		12.3			12%
<b>Total about overall of which</b>	<b>26,000,000</b> <b>30,000,000</b> <b>12,744,000</b>	<b>for grain</b> <b>ha</b> <b>ha (almost 50%) have decreased yield trends</b>			

Source: FAOSTAT

#### 4.4.2 Objectives and Priority Setting

The ALP goal is to improve food supply, food security and livelihoods of resource-poor smallholder farm families in all maize growing countries of Sub-Sahara-Africa. The Program has one major objective: In close collaboration with partners from NARS, SRO's, NGO's, private sector, farmers, and others develop and disseminate improved maize varieties, production technologies targeted at maize-based systems and related policy recommendations that contribute to higher and more stable farm-level productivity, improved nutrition and livelihoods of resource-poor smallholder families while protecting and enhancing the natural resource base. This objective has 9 components shown in Table 4.2 with the projected changes in their relative priority in 10 years time.

**Table 4.2 – ALP Research Components and Resource Allocation**

	Budget allocation %	
	Current	in 10 years
1. Stress tolerant and nutritionally enhanced germplasm developed and delivered	29	20
2. Improved seed systems for resource-poor developed and deployed	10	9
3. Diversified CNRM packages, including for post-harvest, developed and deployed	23	27
4. Biotechnology and other new tools applied	7	13
5. Human resource capacity enhanced	10	10
6. Partnerships developed and enhanced to better serve the resource-poor	9	8
7. Participatory development and deployment of agricultural technology	6	8
8. Policy recommendations to enhance technology adoption	4	3
9. Wheat technology developed and deployed	2	2

Priority setting was based on experience over the last 10 years. The Program plans to alter the relative allocation in the future. Compared to today, germplasm development is expected to attract decreased funding, whereas the use of new biotechnology tools and NRM are expected to receive increased funding.

#### 4.4.3 Program Structure

In 2005, 21 scientists (total of 16.9 FTE) were involved in the Program. The Program Director and 6 other scientists are located in Nairobi, Kenya. Three full time scientists are located in Ethiopia and 7 in Zimbabwe. Four scientists from the headquarters in Mexico are involved part time in the Program. The team is well balanced with a good mixture of experienced and young well trained scientists.

#### 4.4.4 Projected Outputs and Impact

The Program plans to deliver outputs related enhanced germplasm benefiting from farmer participation and inputs, NRM and pest control technologies, information and capacity. By 2007 the outputs will include: Maize germplasm with improved stress tolerance, nutritional quality, herbicide resistance for Striga control and traits required for integrated maize-livestock systems, oil or starch production; Improved seed systems throughout SSA; Improved wheat varieties and technology; Improved soil fertility and adoption of conservation agriculture practices; Improved storage pest control; Alternatives for crop

choice, including cash crops; Assistance intellectual property, regulatory issues, and biosafety; Institutional and partnership capacity, including in farmer participatory research and seed systems.

The Program aims at reaching impact through: improved maize varieties and hybrids with good adaptation and added grain values; RCTs combined with specifically adapted varieties and hybrids resulting in sustainable cropping systems; most appropriate cropping systems and increased yields/ha resulting in increased on-farm water productivity and soil fertility; Increased feed and fodder value in maize varieties/hybrids; Improved nutritional value of maize grain and maize products; and Strengthened capacity on research, human resources and technology transfer.

#### 4.4.5 Assessment

This is an exciting and challenging Program and will be seen by many as a critically important one for CIMMYT. It is also one which, if it has early successes, is likely to generate increased ongoing support. The Panel was impressed with the breadth of the Program and the quality and enthusiasm of the staff involved. Nevertheless it did have two concerns; one in relation to the assumptions underlying the major objective of the Program and the second the feasibility of effectively undertaking all nine components in the same time frame.

The major objective of this Program is very ambitious. While the development of improved germplasm and better production technologies are CIMMYT's strengths the dissemination and uptake of these technologies are dependent on a large number of factors over which CIMMYT and its current partners have little influence, and which may threaten the perceived success of the overall program. Further, the Panel feels that some of the assumptions in the ALP MTP for reaching the broad goal of this Program are unrealistic and are largely out of CIMMYT's control. For example, one key assumption appears to be that all the governments of 33 countries in SSA are committed to the same goal as CIMMYT. Does CIMMYT really expect this to happen in the near future?

While the relative priorities of the nine components, as reflected in the relative allocation of resources amongst them, are hard to argue against, a key question is whether the projected total budget is big enough to make significant impact in all 9 components and, hence to generate sufficiently large continuous gains in productivity per unit area to improve the livelihoods of the resource-poor rural populations. The Panel was concerned that the limited budget for the project was in effect thinly spread over a wide range of activities and that this spread of activities will ensure that all are done sub-optimally with the limited resources available. The Panel **suggests**, therefore, that the Program should carefully examine its priorities with a view of better supporting the higher priority activities and deferring less pressing priorities for future years or until additional specific project funding is available to CIMMYT and/or its partners.

The Panel felt that the highest priority was the development of germplasm for the low to very low yielding Marginal Maize Production Areas (MMPAs) with specific traits, including grain quality traits, required by producers. The second most important priority was the development of a viable and profitable seed delivery system in the SSA. Without the

existence of an effective seed delivery system it will not be possible to routinely deliver the improved germplasm generated by CIMMYT to farmers.

*The Panel recommends that maize research in CIMMYT identify the high priority Marginal Maize Production Areas (MMPAs) in each mega-environment. Based on such MMPAs, a seed delivery system for improved cultivars should be developed jointly with partners as a vehicle to make CIMMYT's upstream maize research results available to resource-poor farmers.*

A third area of concern for the Panel was, in the light of the controversy surrounding the release of GMOs, the relative emphasis given to transgenic and non-transgenic sources of insect resistance in maize in the Program. The Panel feels the research started in the 1970s on host plant resistance at CIMMYT should perhaps be accorded a higher priority in the new regional Program than it currently has. The total funds allocated to host plant resistance research for the last 14 years was US\$ 2.9 million, compared with the total investment of Bt related insect work of US\$ 12 million. Donor material with effective insect resistance has been identified but over the last decade it has not been used effectively in the most advanced breeding material. New modern breeding tools are now available for successful integration of such polygenic resistance during the breeding process for selecting better MV's. This level of resistance may be more sustainable, much easier to handle in seed and trade systems, and can have enormous impact on stabilizing yield at higher levels in MMPA's.

In addition, in its review of the maize breeding activities across Programs 1, 3, 5 and 6, the Panel identified several other areas of maize research of importance to the delivery of outputs in the ALP, including breeding to reduce mycotoxin contamination, use of fast track technologies to reduce the time to market for improved germplasm, and the safe storage of the back-log of maize breeding data so that it is available to the new Programs in an easily accessible format and is not in danger of being lost forever with the departure of long serving staff.

*The Panel recommends* that maize breeding and research efforts in the following areas be intensified:

- *Grain quality characteristics of high priority to end users in MMPAs, combined with more systematic research and breeding to reduce mycotoxin contamination on the grain;*
- *Testing and evaluation of breeding materials directly in the MMPAs, for identification of the best material for release;*
- *Non-transgenic host plant insect resistance research to speed up the process of integration of the highly resistant CIMMYT germplasm into new varieties;*
- *Application of fast track breeding techniques (doubled haploid, MAS, NIR techniques) in all maize breeding activities in CIMMYT;*
- *Acquisition, storage and management of maize breeding data to eliminate the current back-log.*

#### **4.5 Rainfed Wheat Systems**

Rainfed Wheat Systems Program (RFWS) is an eco-regional Program focused on producing outputs for smallholder farmers in the rainfed wheat areas of lesser developed countries

(LDCs). About 56 million ha of wheat are grown in LDCs, principally in CWANA (21m ha), northern Kazakhstan (11m ha), Latin America (8.5m ha), China (7m ha) and India (6m ha). Spring wheats (23m ha), facultative and winter wheats (19m ha) and high altitude wheats (14m ha) all have an important place in the target areas. In these areas, crop production systems are based on bread and durum wheat, barley, and pulses although maize is an important crop in some areas and triticale has shown great potential as a food and fodder crop. Livestock are also a key component in many areas. Rainfall is variable and drought is common, therefore wheat yields are low averaging 1.6t/ha across all LDCs. The growing period is short and options for diversification limited. Land degradation therefore results from overgrazing of pastures, intensive tillage of arable land, and the grazing of crop residues. Food security often depends heavily on wheat, which sometimes provides more than half of the calories consumed daily and micronutrient mal nutrition is widespread.

#### **4.5.1 Objectives and Priority Setting**

The overall theme of Program 4 is reducing vulnerability by managing risk in rainfed systems. Its broad objective is to reduce poverty by increasing the ability of farm households to manage the risks to their livelihoods by improving local and regional food, feed and fodder security in rainfed wheat systems and by slowing or halting land degradation.

Priority setting for this Program was carried out as part of the extensive consultations undertaken in 2002/2003 for the new CIMMYT strategic plan and in the formulation of the applications for the three CGIAR CPs (Water and Food, HarvestPlus, and Generation) to which CIMMYT contributes. While there have been no formal ex ante economic studies to underpin the priority setting process, CIMMYT scientists have been re-examining the concept of mega-environments that CIMMYT has used to develop targeted germplasm for specific environments and particular biotic and abiotic problems for about the last 18 years. CIMMYT has developed a new system of classification that better allows it to estimate the probability of sustainable impact based on the major stresses and the technologies available or under development to counter each stress. This system has been used to determine the medium –term priorities for this project.

The Program has three specific objectives each with a number of components:

**Objective 1:** The development and transfer to partners and farmers of new or improved crop or agronomic components in sustainable wheat-based production systems.

##### **Components:**

1. Development, characterization and distribution to partners of specific trait gene-pools
2. Genetically diverse wheat varieties made available to partners
3. RCTs developed, tested and adopted with partners and farmers

Seventy percent of the Program resources will be targeted at this objective and this level of commitment is expected to remain constant over the next five years. However, the relative importance of the three components is expected to change over time with the level of resources going to component 3 increasing to 25% from 11% at present principally at the expense of component 2.

**Objective 2:** The characterization of agroecological, societal and livelihood environments faced by partners and farmers involved in rainfed wheat systems.

**Components:**

1. Better characterization of rainfed crop and livestock systems, and the use of the information to target and monitor technology development goals
2. Risk assessment of potential adoption of new technologies and reoccurring environmental and socio-economic stresses, in the context of livelihood security, understood and quantified

Ten percent of the Program resources will be targeted at this objective. Again this is expected to remain constant over the next five years. Of this 7-8% will go to component 1 and 2-3% to component 2 with these levels of expenditure stable until 2009.

**Objective 3:** Strengthening of institutions, including CIMMYT and partnerships, to increase capacity to contribute to CIMMYT's mission.

**Components:**

1. Increased capacity of partner and CIMMYT research activities achieved
2. Training of NARS increased in areas of specific need
3. Technology and information dissemination
4. Impact assessment

Twenty percent of the Program resources will be targeted at this third objective over the next five years. Four percent of the resources will go to each of components 1, 3, and 4 and eight percent to component 2. Commitments to these components are also expected to be stable over the next five years.

#### **4.5.2 Program Structure**

In 2004, 24 scientists were involved in the Program contributing the equivalent of about 14 person years. The Program director and nine other scientists are located in the region, principally in Turkey and Kazakhstan and other CWANA locations, while 14 scientists involved in the Program are located in Mexico. Both headquarters and regional staff contribute about 7 person years to the project.

*Pre-existing Elements* - This Program was built around a number of ongoing projects, the bulk of which are supported largely or entirely on special project funding, that were targeted at the major production problems in areas dominated by rainfed wheat production systems. In the area of germplasm development and breeding these included projects aimed at the development of drought tolerant spring wheats, breeding for durable resistance leaf rust and yellow rust, and the IWWIP.

*New Elements* - Overall, there are only a limited number of new elements in the RFWS Program. Since the bulk of the projects are supported by special project funding, much of the immediate research agenda is fixed. However, it is expected that a number of new elements will be introduced over time as a result of new interactions with partners, new proposals for special project funding, and as a result of CIMMYT's participation in the CPs.

These include greater emphasis on crop livestock systems with ILRI in SSA and SEA and other partners in CWANA and greater emphasis on conservation tillage in wheat based farming systems with NARS partners in CWANA. It also includes a greater emphasis on wheat quality and seed systems which are an increasingly important priority for developing countries in South Asia and CWANA. These new activities will result in a significant shift in funds from wheat breeding, particularly the development of finished cultivars. It is anticipated that as NARS grow stronger the emphasis in CIMMYT's Program will shift from the provision of fixed lines to segregating populations.

#### **4.5.3 Projected Outputs and Impacts**

RFWS plans to deliver drought tolerant, input responsive, disease resistant wheat germplasm and fixed lines including: Drought tolerant, disease resistant spring and winter wheat cultivars and germplasm with enhanced value added traits; Cultivars tolerant to Zn-deficient soils and soil-borne diseases; Combined Zn deficiency tolerance coupled with elevated Zn concentration in the grain; Durable resistance to leaf and stripe or yellow rust incorporated into a wide range of germplasm targeted at rainfed areas; Resistance to root rots and nematodes combined in elite winter and spring wheat germplasm; Cultivars adapted to zero-till conditions in a range of ecologies; and High altitude wheat cultivars for Northern Kazakhstan and Siberia resistant to leaf rust with improved quality and high yield. Outputs on RCTs include: No-till farming systems, crop rotations, residue retention, green manure and appropriate machinery for use in conservation agriculture developed or modified for smallholder farmers; The Program outputs also include: Crop diversification and improved crop/livestock systems; Policy analysis and advocacy to foster market development; and Institution and partnership capacity building including: Training courses for NARS partners; Farmer participatory research, technology validation and dissemination; Development of improved seed systems.

The projected impacts of this Program are expected to come through: Release and adoption of improved bread and durum wheat, triticale, and maize cultivars that improve production in rainfed wheat systems of the developing world; Increased sustainability of cropping systems through adoption of RCTs together with varieties specifically adapted to them e.g. wheat and maize varieties with increased drought tolerance, better nutritional quality and durable pest and disease resistance; Increased on farm water productivity and soil fertility by expanding cereal –legume rotations and diversifying crops and cropping systems; Increased feed and fodder supplies for livestock and poultry systems; Improved nutritional value of wheat and wheat products; and Strengthened research, human resource and technology transfer capacity.

#### **4.5.4 Assessment**

RFWS is a well targeted Program that focuses on the major constraints, drought, leaf and root diseases, land degradation, micronutrient stresses, and end-use quality affecting the livelihoods of smallholder farmers dependent on farming systems in which the major crop is rainfed wheat. It builds on and strengthens the highly successful spring wheat Improvement Program focused on drought, and the IWWIP. It is likely that this Program will produce early and measurable impacts. For example, there are already 34 new winter wheats scheduled for release in coming years. Similarly, the Program has exciting spring wheat

germplasm in the pipeline with improved seedling vigour, disease resistance and yield under drought.

However, the Panel identified several areas of concern or future challenges in relation to this Program and these are discussed below. Some of these came from CCERs and others from the visits to and interaction with CIMMYT staff and its regional offices during this EPMR.

#### **4.5.5 Outstanding Issues and Future Challenges**

##### *4.5.5.1 CIMMYT-ICARDA Relationship*

Program 4 operates extensively in the CWANA region, which is at the core of ICARDA's mandate. The relationship between CIMMYT and ICARDA is therefore of critical importance to the success of the Program. As highlighted in Chapter 7 relationships between CIMMYT and ICARDA have deteriorated over the last two years. The CCER of CIMMYT's Wheat Breeding Activities noted that it was "essential that both CIMMYT and ICARDA define their own unique roles as well as rationalize each Center's collaborative role in wheat improvement research in the CWANA region". A working group, involving senior scientific and managerial staff of CIMMYT and ICARDA, met during February 8-11, 2005 in Amman, Jordan to develop a joint matrix of CIMMYT and ICARDA wheat related activities in the broader CWANA region as a first step in enhancing their relationship. The Panel regards this as a positive step but **urges** CIMMYT to continue the rationalization and stabilization of its relationship with ICARDA as a matter of the highest priority.

##### *4.5.5.2 Succession Planning for Wheat Breeding Staff*

The CCER of CIMMYT's Wheat Breeding Activities noted that following the significant reduction in staff in the former Wheat Program in 2002/2003 (approximately 35% overall, some 14 senior scientists) the critical mass required to continue wheat improvement at CIMMYT was at an alarmingly low level. They also noted that the loss of one or two senior staff at this point would have a very significant impact on CIMMYT's capacity to deliver its planned outputs and impacts and further, there was no clear succession plan in place to retain corporate knowledge if staffing changes did occur. This issue is particularly acute for the RFWS, and has been exacerbated by further staff reductions in 2004. The response of Management to the CCER Panel's concerns was non-specific, non-committal and unconvincing. The issue remains unresolved and the Panel **urges** CIMMYT to address this issue in a realistic manner or risk losing significant donor support.

##### *4.5.5.3 Communication with CIMMYT partners*

A number of CIMMYT partners, particularly in South Asia but in other areas as well, have expressed deep concern about the level and strength of commitment to wheat breeding at CIMMYT. This concern appears to have been generated by the rapidity and depth of the budget cuts to the former wheat Program, particularly compared to maize, and the apparent de-emphasis of wheat breeding in the new strategic plan. This concern also appears to have deepened by the further staff changes that were announced immediately after the initial phase of the EPMR in the second half of November 2004. CIMMYT depends crucially on effective interactions with NARS and other regional partners. Many established links between CIMMYT staff and their partner staff in the regions have been disrupted by the change in staff profile and duties and it is critical that the new Program leaders re-establish these links to maintain confidence. The EPMR Panel wishes to strongly reinforce the

recommendation of the CCER of CIMMYT's Wheat Breeding Activities that the new Program directors should begin the task of meeting with all NARS and ARI customers and partners to provide a communication bridge as CIMMYT moves forward to fully implement its new mission statement and research Program.

#### *4.5.5.4 Costing of the Components of the Wheat Improvement Program*

The previous EPMP recommended CIMMYT develop a full costing of the components of its Winter Cereal Improvement Program for two reasons. The first was to provide a basis for CIMMYT to recover the full costs of research undertaken on restricted and special project funding. It was obvious even at that time there was a clear trend in the CGIAR for unrestricted funding to decrease, and to offset this, the Centers would need to move to cost recovery from restricted and special project funding. The second was to provide a basis for the breeders to make objective choices in terms of the incorporation of technologies such as rapid backcrossing, double haploids, MAS and NIR for quality assessment in the Program. The logic was that the total funding available to the Program was unlikely to increase dramatically and hence, the routine incorporation of new technologies into the breeding Program was only going to be accomplished by shifting resources from current activities to new activities. To make these sorts of decisions in a timely and effective way requires information on the relative costs of both the old and new technologies.

Seven years down the road and CIMMYT still does not have costings for many of the components of its breeding activities. This is despite a very significant reduction of 35% in the size of the wheat Program over the last 3 years and the obvious need to restructure and reorganize the Program in line with the new structure. The Panel is of the view that the need for an assessment of the full costing, and the charge back of those costings to restricted and special projects where possible, for all services to research Program including the wheat improvement activities in GRP, RFWS, and IAP (Intensive Agro-Ecosystems Program) is now an absolute priority for CIMMYT management (see also Chapter 9).

#### *4.5.5.5 Marker Assisted Selection*

Marker assisted selection has a key role to play in the future breeding activities of both wheat and maize. CIMMYT has slowly been increasing its capacity in the routine use of molecular markers in wheat breeding and related research activities. Around 18,000 assays were performed in 2003/2004 but the demand is expected to rise exponentially over the next few years reaching 60,000 assays by 2006 and potentially several times that number by 2010. CIMMYT has lagged behind other CGIAR Centers, as well as private breeding companies, in increasing its capacity to service the rapidly growing needs of not only its wheat improvement activities but those of its NARS partners. A similar situation applies to DNA extractions. These can currently be performed at around 200-250 per day which the CCER concluded was well below best practice. It is clear that CIMMYT needs to upgrade its DNA extraction capability and develop a high throughput marker service laboratory dedicated to meeting the needs of wheat and maize breeding as well as the associated research groups in genetic resources. An issue for CIMMYT is whether it should be involved in marker development or access markers developed by the many public and private institutions involved in this area of research. The EPMP Panel feels that CIMMYT should leave the development of markers to others and instead focus on their use in the development of

germplasm targeted at smallholder farmers except in those rare instances where markers are not available or under development for a particular trait of high priority to CIMMYT.

CIMMYT also needs to keep a close watching brief on developments in high throughput marker technology. New technologies are on the horizon which would, if they are commercially successful, offer high throughput, low cost (10-20c/data point against current cost of \$1-2/data point) molecular marker applications in wheat improvement. Again CIMMYT's prime interest will be the use, rather than the development, of these technologies to enhance its wheat improvement activities once they have been shown to have application.

#### *4.5.5.6 Enhancing the Rate of Production of Improved Winter Wheat Cultivars*

The IWWIP, a joint venture between Turkey's Ministry of Agriculture, CIMMYT and ICARDA, has been highly successful in developing improved winter wheat cultivars for the CWANA region. However, it currently takes 12-15 years for IWWIP to breed a variety and get it to farmers' fields, because the vernalisation requirement of winter and facultative wheats limits the breeder to one generation per year. This contrasts sharply with their spring wheat breeding counterparts in Mexico who use "shuttle breeding" between Toluca and Obregon to routinely grow two generations per year, which not only enhances adaptability, but halves the time taken to develop improved germplasm for distribution to their NARS partners. However, the Panel felt that the strategies, based on the use of double haploids that are available and are in use in commercial programs in developed countries to enhance the rate of production of improved winter wheat cultivars, should be seriously considered for implementation in the IWWIP.

## **4.6 Tropical Ecosystems**

The Tropical Ecosystems Program (TES) emerged from and builds on the former Maize Program, although activities in Africa have now been housed in ALP and the maize germplasm bank and associated "pre-breeding" activities have been housed in the GRP.

### **4.6.1 Objectives and Priority Setting**

The Program Goal is to: Improve the livelihoods of resource-poor farmers in the tropics by increasing the productivity and profitability of farming systems that include maize (or wheat).

TES has two main objectives with a number of Components:

**Objective 1.** Farmers' livelihoods and well-being are improved by TES Program's products.

#### **Components:**

1. Improved maize varieties with stress tolerant and high quality
2. Development of appropriate crop management options
3. Development of methodologies for appropriate technologies
4. Documentation of the impact of technology

This objective is allocated 75 % of the total resources. Allocation of resources within Objective 1 would be 51, 10, 25 and 14 % for the component 1, 2, 3 and 4, respectively.

**Objective 2.** Capacity of others to contribute to our goal is enhanced.

**Components:**

1. Professional development opportunities
2. Promotion of partnerships
3. Information dissemination

This objective is allocated 25% of the total resources. Allocation of resources within Objective 2 would be 25, 45 and 30 % for the component 1, 2, 3 and 4, respectively.

In the priority setting for this Program, the starting point was the new strategic plan document "Seeds of Innovation", where the primary products of TES were defined as "...high-yielding, stress-tolerant, nutrient-enhanced maize germplasm with resource-conserving technologies."

With this in mind and via an iterative process, TES scientists developed the Program logframe, which encompasses the objectives and component activities that appear above. The logframe is an evolving, document but it is being used to set individual scientists' workplans for 2005 and will be used in the future in assessing progress.

The other dimension to priority setting for TES was defining where the Program will focus its efforts. Geographically, the TES mandate area is huge, including most of Latin America, much of Southeast Asia, and a considerable area in South Asia (mainly tropics of India). Some of TES efforts can be readily deployed to all its mandated regions and clients, for example through international trials and by responding to seed requests for experimental germplasm. To focus the Program's efforts where this was not the case, the "Resource Allocation Tool" (RAT) was used. It was developed by CIMMYT scientists in connection with the new strategic plan.

The RAT that deals with maize and wheat in Latin America and South and Southeast Asia is based on a model, which emphasizes poverty and the importance of maize and wheat as a food source. Priority countries within regions and globally are identified; 80% of TES's effort should be targeted to South and Southeast Asia, especially Nepal, India, Indonesia and Philippines; 20% in Latin America, especially Guatemala, Mexico and Haiti. Additional factors are considered in priority setting in TES, such as strength and resources of the national program (e.g. India is very strong, hence receives lower priority than suggested by the RAT), and practical considerations (e.g. it is scarcely possible to work in Haiti due to political instability). The RAT uses two key parameters: Importance and Poverty:

IMPORTANCE 1 = Agricultural Population \* SQRT (Per Capita Consumption of Maize or Wheat \* (Maize or Wheat Area / Total Cropped Area).

POVERTY 1 = Human Poverty Index published by UNDP (squared). It is based on the adult literacy rate, the probability of surviving to age 40, the proportion of children under the age of 5 who are underweight, and the proportion of the population lacking improved water sources.

Priority setting is further refined by reference to practical considerations, mainly funding and staffing (in Southeast Asia there are only few CIMMYT staff), and “conducive” conditions (e.g. capable/willing partners, security concerns, etc.).

#### 4.6.2 Program Structure

TES scientists are heavily concentrated in Mexico (8 scientists), and there is a single outposted scientist in each of Colombia, Nepal and Philippines.

*Pre-existing elements* - The following incomplete list summarizes the “major” elements:

- Maize breeding, consisting of three breeding components: 1) lowland tropical; 2) highland; and 3) acid soils (based at CIAT, Colombia). Each of these components works both on QPM and “normal” maize and each develops both hybrid and open-pollinated germplasm.
- Stress tolerance applied and basic research, consisting mainly of three components: 1) pathology, focusing on developing “source” germplasm and support to maize breeders to develop germplasm with enhanced resistance to primary diseases of maize; 2) entomology, focusing on stem borer and post-harvest insect resistance; and 3) physiology, focusing on drought, low soil nitrogen, and acid soil tolerance.
- Nutritional enhancement, mainly pro-vitamins A, Fe and Zn work, associated with the HarvestPlus CP. This research was previously “based” at the CIMMYT Harare office, but now has been moved to Mexico. Capacity in this area is still very limited, but will be growing particularly with the arrival of a post-doctoral fellow in January 2005.

*New elements* - The emerging or required (new) elements of TES include:

- Agronomy, “conservation” agriculture (e.g. reduced tillage), ecosystems analysis. TES does not have any scientists with expertise in these areas, which are crucial to fulfilling the new mandate. A TES physiologist is beginning some of the required conservation agriculture work, but this is not his area of expertise. This is a major gap in the Program’s current capacity, and TES will need to secure expertise in these areas in the near future.
- Social science expertise, e.g. livelihoods analysis, poverty targeting, and pathways to maximize impact on these. Two social scientists are assigned part-time to TES. CIMMYT is strengthening this capacity within ITA, but it is questionable if the current commitment will fulfil the needs of TES.
- Farmer-participatory research. This is not a new area for TES, but the current activity in this area is low. Within the former Maize Program, the scientists in Africa were the most experienced and active in this type of work, followed by the scientists in Nepal and Ecuador. Recent/emerging efforts in Mexico in “allele introgression” are exciting and need additional resources and efforts. In general, TES work in Asia and Latin America needs to evolve methods that increase adoption of technologies and impact on resource-poor farmers; farmer-participatory research often increases impact on risk-averse, resource-poor farmers.
- Physical presence. TES urgently needs to increase its presence in Asia, where the Program would like to allocate the majority of its resources (the RAT **suggests** 80%).

#### 4.6.3 Projected Outputs and Impacts

Activity areas of TES include maize breeding, crop and system management, policy targeting and inputs, technology transfer, and training. In the breeding Program, development of

stress tolerant germplasm suitable for lowland and highland tropical environments is a priority. Another important breeding objective is development of germplasm with enhanced nutritional value, particularly high-lysine maize (QPM) and increased pro-vitamin A.

Changes in emphasis are expected among objectives and outputs of the program between now and 2010. Overall, plant breeding activities are expected to decrease (60% to 40%) whereas crop and system management is expected to increase (20% to 40%) in this period, whereas training related activities will remain at about 20%

#### **4.6.4 Assessment**

The Panel feels that it will be difficult to assess the achievements of the TES Program at the end of the 3+ year period against the activities listed in the logframe, as the verifiable indicators are only qualitative and not quantitative. Some other Programs have shown the indicators in quantitative terms.

The Panel is concerned about the decline in maize breeding, particularly in three areas: breeding stress tolerant productive maize suitable for resource poor farmers in lowland and highland tropical environments, breeding maize germplasm with enhanced nutritional value, especially high-lysine maize (QPM) and increased pro-vitamin A, and introduction of elite alleles (e.g. drought resistance or lodging resistance) into farmer preferred germplasm. Had some of these activities already achieved their goals, scale down could be justified. However there does not appear to be good evidence for this in the target regions concerned. The Panel **suggests** maize breeding will focus on key traits of importance for selected environments that are high priority for achieving the goal of the TES. Current momentum for development of QPM should be maintained, as well as for the development and vigorous testing of new germplasm.

Recommendations listed for the maize breeding activities in ALP also apply here and will not be repeated in this section.

The Panel commends the Program for its intention to increase activities for crop management for farming systems. The CIMMYT work in Mexico indicates that components of conservation agriculture may be critical to the achievement of higher and more stable maize yields. Verifying different methods with farmers' involvement in participatory projects would facilitate identification of technologies that can be adopted by farmers quickly. The Panel noted that maize agronomy research was weaker than that for wheat in CIMMYT, and this initiative could potentially change this historical trend. However it is of vital importance to determine what kind of crop management research is required for different countries and environments so that the research is well focused and has a high chance of success.

While the TES Program is strong in maize breeding, it has no agronomist. The importance of having agronomists in the region, particularly in Asia, was also emphasized for IAP, and the two Programs should share the person who is stationed in the region. A similar point can be made for other disciplines such as the social sciences. CIMMYT does not have sufficient resources to appoint a comprehensive range of specialists in each of the four ecoregional

Programs, and sharing of positions between the Programs would be a good use of the limited available resources.

CIMMYT's fourth EPMR included a recommendation that "...the NRG make conservation tillage and related soil and crop management practices the primary research focus of the NRG, with the goal of quantifying the effects of conservation tillage on water and nutrient use efficiency, soil quality, and productivity of maize and wheat based systems." This has been partially met, but the effect of conservation tillage on water and nutrient use efficiency, and soil quality needs to be quantified further in the natural resources management activities taking place within the new ecoregional programs. The lack of human resources to conduct this kind of research has been identified and efforts are being made to rectify this shortcoming (see also Section 4 on IAP). In order to advance resource use efficiency, there is need to develop and monitor balance sheets for different resources such as water and nitrogen This may best be achieved through the collaboration with ARIs.

***The Panel recommends that: a) crop management research in TES in the regions be strengthened by allocating NRM staff time from other programs, particularly IAP, to TES; b) CIMMYT, TES in particular, seek collaboration with other CGIAR Centers in the region, including shared appointments of agronomists and other natural resources specialists; c) the Crop and Resource Management Group, TES and other ecoregional programs enhance strategic research on natural resource management, particularly for improved water and nutrient use efficiency.***

The RAT analysis conducted for maize and wheat in the regions targeted by TES has strongly influenced the direction of the Program. While the analysis appears useful in guiding research direction it does have its limitations. For example, the analysis indicated that 30% of the total TES resources should be allocated to Nepal. While Nepal has a high level of poverty, a high rural population, a high proportion of resource poor farmers and a lack of alternate research services suppliers, this figure appears too high, relative to the size of the population of the country.

Increased use of maize as feed in Asia needs to be considered when TES further formulates its research activities, including germplasm development as well as agronomy research. It is likely that the demand for feed will further increase in the region in the near future. This should be also considered by IAP.

The Panel endorses the Program's plan to increase activities and to increase the number of scientists in Asia, where the number of poor people is still vary large. However the number of staff in Asia and in headquarters in Mexico needs to be carefully balanced, particularly for those engaged in maize breeding which has made excellent progress using facilities available in Mexico. Testing of breeding materials needs to be conducted in most appropriate locations. TES needs to establish which parts of Asia and which particular environments will be the focus of its maize breeding and crop management.

Agronomists in regional centers are often involved in information dissemination to communities and farmers, and that role would be appropriate.

Considering the strong association with IAP, particularly in relation to maize breeding in Asia, the Panel **suggests** that TES, together with IAP examine the location(s) where maize breeding could be most effectively executed for the target regions in Asia.

#### **4.7 Intensive Agro-Ecosystem Program**

Intensive Agro-Ecosystems Program (IAP) emerged from and builds on elements of the former Wheat Program, the NRG (mostly those working in wheat cropping system) and the former Maize Program, particularly work relating to subtropical environments and other intensive agro-ecosystems outside SSA, East Asia or Andean Latin America. About 30 senior researchers work in this Program for targeted regions of Asia, North Africa, and Latin America.

Development of sustainable and profitable cropping systems is central to reducing poverty in Asia, which still has the largest number of poor people in the world. Intensive systems are usually irrigated and highly productive, featuring multiple crops (including large areas of maize and wheat) and face serious problems, including the unsustainable exploitation of water and soils, inefficient use of chemical inputs, and emerging or worsening disease and pest problems. IAP conducts research to overcome these limitations and ensure that the key agricultural areas remain productive and ecologically sound into the future. Farmers in these areas tend to be more market-oriented and driven by the need to sustain local communities and neighbouring cities.

##### **4.7.1 Objectives and Priority Setting**

Through partnerships with national and international scientists, IAP undertakes research that promotes intensive maize and wheat cropping systems that improve rural incomes and livelihoods. Beyond a focus on higher grain yields and value-added wheat and maize cultivars, IAP will seek a more efficient use of water and other inputs, better management of biotic stresses, and enhanced system diversity.

The main goal of the Program is to reduce poverty and conserve natural resources in densely-populated areas, where intensive maize and wheat systems underpin the livelihoods of the poor by improving incomes for poor farm families, fostering expanded employment for the rural landless, improving food security for rural consumers and conserving water and land resources.

There are 4 objectives in the Program, each with a number of special projects:

- Objective 1 (30% of resources; two special projects): Expansion of high-value, labour-intensive crop and livestock activities in maize and wheat systems
- Objective 2 (40%; 23 special projects): Production technologies that better tolerate biotic and abiotic stress, improved post-harvest storage of food, and supporting policies
- Objective 3 (15%; 5 special projects): Improved resources use efficiency, improved soil health and reduced land degradation
- Objective 4 (15%; 7 special projects): Capacity strengthening and targeting

IAP's priorities were determined at a meeting IRS in the Program at Chengdu, China, in September, 2004. The Program scientists realized that there were no large adjustments

required in priorities between current activities and desirable future activities, as IAP already has made substantial investments in areas of interest to the “new CIMMYT”; changes that other Programs are currently considering. Nevertheless, some adjustments were made to take up new opportunities. The weight given to crop improvement was reduced slightly (from 49% to 47% of resources) and the focus tightened, with a lower priority assigned to general crop improvement and a higher priority given to developing materials compatible with new conservation agriculture practices, efficient water use, and resistance to storage losses. The research Program was further revised with the arrival of the new Director of the Program.

#### 4.7.2 Program Structure

Until 2004 IAP researchers worked in Mexico (15 with in the Program, and 3 with housed in other Programs), South Asia (Bangladesh [1], India [3], Nepal [3]), CWANA (Turkey [1 but housed in another Program], Georgia [1 housed in another Program], Kazakhstan [1 housed in another Program], Afghanistan [1 housed in another Program]), China (1), and Latin America Southern Cone (1 in Uruguay).

*Pre-existing elements* - The continuing elements of IAE include:

- Wheat breeding, consisting primarily of four breeding Programs: 1) bread wheat; 2) durum wheat; and 3) triticale (main work in Mexico), and 4) winter wheat (in Turkey).
- Conservation agriculture, consisting mainly of research undertaken at: 1) rice-wheat cropping systems in South Asia; 2) wheat cropping systems in Mexico; and 3) new tools for agronomy.
- Nutritional enhancement, mainly Fe and Zn research, associated with the HarvestPlus CP both in Mexico, South Asia and Turkey.

*New elements* - The emerging or required elements of IAP include:

- Decentralized breeding. IAP plans to undertake maize breeding for subtropical environments based in both Mexico and India to enhance adaptability of this germplasm. Likewise, through a new partnership approach with NARS involving a visiting scientist arrangement, wheat breeding will be undertaken with regional Programs for South Asia and Latin America Southern Cone. Similarly, and due to recent outbreaks of rusts, international shuttle breeding may be undertaken, if resources are available, in selected locations where new and more virulent strains are evolving.
- Social science expertise, e.g. livelihoods analysis, poverty targeting, and pathways, by seeking this professional capacity through the ITA.
- Plant Health Management. This is not a new area for IAP, but the level of pathology expertise in the Program is well below the minimum level required to service a global research effort in wheat and maize. Three additional IRS are required to meet the objectives of the Program- two in plant pathology, and one in nematology/root health.
- Diversifying, intensive agro-ecosystems. A two-pronged approach: a) seeking other uses for maize and wheat (e.g. food-feed dual purpose cultivars, bio-fuel, raw materials for industry), and b) “high-value” crops for rotation and income (e.g. vegetables, oil crops).

The annual IAP budget for 2004 was about US\$ 9.3 million. This amount includes investments through the RWC. About 22% of Program resources are provided by CIMMYT’s unrestricted core budget while the remaining 78% of IAP resources are sought through

restricted funding and special projects. There are almost no expected changes in the proportion of funds allocated to various program activities, reflecting the small amount of change required by the restructuring.

#### **4.7.3 Projected Outputs and Impacts**

Conservation agriculture is a focal area of all Program activities. The Program will contribute to the further development of equipment and other RCTs, suitable cultivars, and crop rotations incorporating a third crop. It will disseminate technology and knowledge within and beyond the South Asia region.

The IAP acts as catalyst in research for development, partnering with conservation agriculture networks and farmer associations. Its role is that of an integrator rather than technology provider only, as issues emerge within the new intensive, diversified and profitable agro-ecosystems.

The IAP emphasizes improvements in system productivity and diversity, and consequently resources devoted to cereal production have decreased. The Program acts as broker of germplasm exchanges and testing beyond mandate crops, e.g. legumes, vegetables, and other industrial crops. It will conduct policy analysis to encourage technology use that maximizes benefits among small producers and poor consumers.

Another emphasis is agenda towards increase in nutrient use efficiency and water use efficiency rather than further increased use of inputs for higher yield. This approach would promote reduction in resource use in the field and the region concerned.

The MTP for 2005-2007+ provides detailed projected outputs for the Program. They are clearly described for the 3 year period and mostly self explanatory, and can be evaluated with the means of verifications indicated in the MTP.

In looking further ahead in 10 years time frame, the Program aims to achieve impact through: Promoting successful adoption of RCT in Asia, Africa and Latin America; Supporting successful adoption and more holistic cropping systems to keep pace with grain demand at affordable costs to the farmers and prices for the poor consumers; Reducing water use in agriculture by more than 20 % and substantially decrease fuel use; Enhancing farmers' access to markets by providing cereal cultivars with added value traits; e.g. quality food for emerging consumers or improving health through better nutrition.

#### **4.7.4 Assessment**

The Panel recognizes that IAP is in the forefront among all CIMMYT Programs in adjusting its structure to meet the new challenges facing CIMMYT. It is to be further decentralized with the move of subtropical maize breeding to South Asia, and the further movement of staff to key regional centers. The Panel commends IAP for its efforts to focus on the target regions where poverty prevails in densely populated areas. While decentralization will allow IAP and, more generally CIMMYT, to focus targeted regions, resources will not be sufficient to have a strong team of scientists of various disciplines in all targeted regions. This point was also discussed for TES.

The IAP will further promote zero tillage of wheat after rice, and investigate zero-tilled rice-based rotations on permanent beds, with rice grown as an aerobic crop followed by wheat, maize, legumes or other crops. Other areas of research include non-traditional rice transplanting practices and surface seeding of wheat after rice in low-lying poorly drained soils. The Panel endorses IAP's attempt to further promote conservation agriculture in the targeted regions.

The rice-wheat system development in South Asia is an outstanding success in the CGIAR System (see Chapter 3 under NRG). This success should be used as an example of technology development and dissemination in collaboration with many partners, and be applied for other regions. However it should be noted that the adoption of the technology is not uniformly distributed within the IGP. Rice-wheat system development should remain the priority of the Program. However, the emphasis should be placed more on the eastern IGP where irrigation water is less available and resource availability is poorer compared with the north western part of the IGP.

Because of excellent agronomy and technology transfer work of CIMMYT, partner institutions and farmers in the rice-wheat systems in southern Asia, varieties that are suited to conservation agriculture are likely to be adopted quickly by the farmers. The provision of technology packages that include both well adapted varieties and sustainable crop management systems are likely to have a huge future impact in the region.

As a reduction in mainstream plant breeding is deemed necessary to accommodate other priority issues within the Program, more targeted breeding is required. The proposed change in the breeding priorities to put more emphasis on the development of varieties that are suited to conservation agriculture is commended. The proposed movement of subtropical maize Program to South Asia should also promote this process of focusing development of adapted varieties that are more readily accepted by farmers.

***The Panel recommends that the IAP breeding teams work closely with crop management and Social Sciences Group to develop cultivars that are suitable for conservation agriculture, use water efficiently and are resistant to storage losses.***

The introduction of new systems require careful long-term evaluation of their sustainability. The rice-wheat system in north western IGP may not be sustainable because of the excessive water use of the rice crop. Similarly in the eastern IGP, some problems (e.g. human diseases) were identified with the introduction of a dry season irrigated rice crop. It is important, therefore, to examine the overall performance of the system sustainability.

***The Panel recommends that IAP undertake long term experiments to evaluate cropping system sustainability with the results being fully utilized for strategic research as well as for demonstration purposes.***

Of the 40 selected journal papers for the last 7 years published by the Program staff, 33 describe work on wheat, 1 on maize, 1 on both maize and wheat and 5 on other themes. While it is recognized that journal publication does not always reflect the good work of the Program, these numbers are an indication of the scientific strength of the wheat group, and

the weakness of the maize group. Pathologists, entomologists, physiologists and agronomists need to develop their capacity to work on both wheat and maize crops so that the regional problems that hinder the achievement of the Program goal can be effectively challenged.

*The Panel recommends that IAP increase its research in maize cropping systems and their development.*



## 5 RESEARCH SUPPORT

### 5.1 GIS Unit

CIMMYT's Geographic Information System (GIS) Unit was established in 1996 with 1 IRS, 1 NRS, 1 IRS Post-Doc, and 1 IRS consultant, all full-time. The mix of skills permitted both crop modelling and GIS to be undertaken. The current (2004) staff is somewhat smaller and consists of 1 IRS and 1 NRS full-time, and one part-time IRS with a small contribution. In addition, an NRS with GIS skills is based in CIMMYT's Delhi office. The current level of staffing and expertise permits only GIS activities and a very small component of remote sensing. Funding is divided equally between restricted project funding and core funding.

#### 5.1.1 Activities and Achievements

In the last five years, GIS unit activities have focused on three central themes, which are considered in more detail below:

- Providing research support to CIMMYT research staff worldwide
- Making GIS accessible to a wide range of staff and partners
- Building capacity in GIS and related areas

##### 5.1.1.1 *Research Support*

Some of the highlights of the Unit's activities in this area are listed below:

- Definition and refinement of mega-environments for both maize and wheat. These mega-environments represent relatively homogenous production zones, determined on a climatic basis, that assist the deployment and targeting of materials and technologies. The latest refinement of the maize mega-environments helped the Maize Improvement Group with priority setting of their activities.
- Spatial assessment of drought risk in southern Africa during different maize developmental stages.
- Development of spatial models predicting post-harvest storage losses in maize.
- Development of optimal maize seed distribution locations and likely demand at each location throughout southern Africa.
- Wheat genebank data with GIS to permit trait exploration (drought) through links to environmental data.
- Application of high resolution satellite imagery in South Asia. This has permitted local level targeting of resource-conserving technologies.
- Development of tools to assist CIMMYT's strategic planning process.
- Rural poverty maps for Mexico. They have been used in the search and selection of trial sites in a breeding program.

These last two activities have signalled a new direction for the unit. The integration of GIS with environmental characteristics marked a substantial improvement in how materials and technologies can be targeted and prioritized.

##### 5.1.1.2 *Making GIS accessible to Users*

The broader use of GIS has been enhanced by the development and deployment of simple, user-friendly tools integrated with spatial databases.

Examples of this include:

- Country Almanacs. These have been developed for over 20 countries in SSA, Asia & Latin America as a result of a long-standing collaboration with a small US-based software company (Mud Springs Geographers – a spin-off from Texas A&M).
- The Maize Research Atlas series. Originally it was developed for Africa, but the success of this product resulted in expansion to other regions (Asia & Latin America) and further updates for Africa (now at version 3).
- Development of web-based interactive applications. They include fully searchable metadata published using international common standards. The latter permits search and retrieval of spatial datasets, plus direct interoperability with various GIS clients. These efforts are being undertaken in collaboration with all other CGIAR Centers (through the Consortium for Spatial Information), with the goal of linking the spatial data holdings of all the CGIAR Centers.

#### 5.1.1.3 *Capacity Building in GIS*

A large component of the capacity building activities undertaken have focused on the user-friendly GIS tools outlined above. These activities have been undertaken in most of the regions where CIMMYT works – Africa, Asia and Latin America. More recently, advanced GIS software tools have been deployed in regional offices and at HQ with some training activities undertaken in parallel. Over 1000 CIMMYT partners in key regions have now participated in GIS-related training workshops.

While GIS activities assisted various research projects, the single most important achievement of the GIS unit has been to raise awareness of the utility of spatial technologies. A major success has been the ability to cross-cut disciplines and programs – all research areas in CIMMYT at some point have benefited from GIS unit activities. One good indicator of this was that 80 to 90% of the 21 projects reported at projects week featured GIS work in their presentations.

#### 5.1.2 **Future Activities**

The Unit will focus on the major activities in the coming year consistent with CIMMYT strategy. Particular emphasis will be given to:

Integrated Information Management

Improved Environmental Classification

Priority setting, impacts an adoption

#### 5.1.3 **Conclusions**

GIS has the capacity to integrate expanding information into a broad knowledge base. It is now recognized that incorporating spatial factors improves decision-making. The usefulness of GIS in the development of environments' classification for plant breeding purposes has been well demonstrated, and this activity together with others should continue and expand. However, the current capacity of the GIS unit is unlikely to match the demands placed on the unit in the immediate future.

The Panel **suggests** that the GIS Unit be strengthened and developed so that it can serve to integrate databases institution-wide. The three areas identified by the GIS Unit: Integrated information management, Improved environmental classification, and Adoption, impacts

and priority setting, should serve as focus areas. In view of the complexities of mega-environment classification and also impact and priority setting, the GIS unit should work closely with all four eco-regional programs and also with the ITA.

## 5.2 Bioinformatics

This research support service can be divided into two parts:

1. **Management of scientific data** at CIMMYT. This includes crop information data as well as the monitoring of seed storage and seed inventory data.
2. **Development of bioinformatics** at CIMMYT. Genomics and functional genomics data need to be managed and made available to users.

CIMMYT has been very slow to improve and rationalize its data storage and handling systems across the institute and to make the data are available to users in a timely manner. A specialist has been recently hired and a coordination group for data management has been formed to manage the large data that CIMMYT researchers have generated but not yet documented, organised and entered into an accessible information system. CIMMYT is generating large quantities of scientific data at substantial cost, but only a limited amount has been entered into an information system and safeguarded for future use. Data are often stored in researchers' computers and only the individual researchers or their close collaborators have access to it. In addition most data are not properly documented.

At this time, it is not possible to combine data from plant breeding, conservation of genetic resources and socioeconomic studies to provide benefits in terms of more efficient development of specific research activities. This means that crosscutting studies are very difficult to implement. An improved data management system would also facilitate data sharing with CIMMYT partners. Of particular concern is the curation of all the historic maize breeding data and the maize and wheat genebank data, including that relating to the inventory management of seed stocks. While staff is now in place to improve this aspect of the center's operations, the Panel **urges** that they be given the support and authority to implement change.

CIMMYT also lacks state of the art bioinformatics capture, storage and analysis capacity. The newly appointed bioinformatics staff at CIMMYT has developed a detailed plan to ensure CIMMYT has the capacity to stay competitive in this rapidly moving area of research. The Panel **suggests** that this plan be implemented and the bioinformatics capacity at CIMMYT be upgraded as a matter of urgency.

The Panel recognizes an urgent need to improve all elements of an integrated data management system in order to produce new tools and information systems.

## 5.3 Grain Quality Laboratory

In the past, the Grain Quality Laboratory (GQL) has provided routine quality testing services to the bread and durum wheat breeding programs at CIMMYT. It has also conducted independent research on both method development in cereal chemistry and, in interaction with the wheat program, aspects of the genetic control of wheat quality.

The GQL recently acquired Near Infrared Spectroscopy (NIR) equipment for the first time. This development is long overdue--this equipment is routinely used in every cereal chemistry laboratory in the developed world. This instrument can be used to screen for a range of quality traits such as grain hardness, ash, protein content, flour colour, starch quantity and composition (amylose/amylopectin ratio), protein quality (amino acids), and feed (grain and forage) value. It also has the capacity to greatly increase the throughput of the GQL and therefore to allow CIMMYT to meet the growing demand among its developing country partners for increased end use quality in its wheat germplasm. However, as noted by the CCER on CIMMYT's Wheat Breeding Activities, appropriate calibrations of this instrument will be difficult to obtain given the wide diversity in CIMMYT's germplasm. Therefore, the Panel fully endorses Recommendation 16 of the CCER that "there is a strengthening of the technical capabilities of the quality work particularly through the use of NIR. An accumulation of a library of samples over years and environments is an urgent need for the achievement of robust NIR calibrations, and collaborations with experienced specialists in ARIs may be required".

In addition to its traditional input into the wheat breeding programs, GQL plans to work on the quality of other crops including maize, barley and triticale, and in other programs such as the HarvestPlus CP. This will require the GQL to develop new skills in terms of the routine testing of a range of critical grain quality traits such as grain hardness, proteins, and starch composition particularly in maize. If the GQL is to have a significantly expanded range of activities in new areas, the Panel **urges** CIMMYT to provide an opportunity for key staff to upgrade their skills in these new areas.

#### **5.4 Seed Inspection and Distribution Unit**

The Seed Inspection and Distribution Unit (SIDU) handles CIMMYT's germplasm exchange and was created recently as a result of consolidation of the International Wheat Improvement Network (IWIN), the International Maize Testing Unit (IMTU) and the Seed Health Unit (SHU). In 2002, before the new Unit was created, there were 20,868 cereals introductions (wheat, barley and triticale) and 9,282 maize introductions, while 35,468 entries of small grain cereals and 12,505 entries of maize were sent out to International Nurseries. Consolidation of the three units into one has reduced some duplication, such as address books where co-operators are often the same in the wheat and maize breeding programs, and will lead to unified database systems.

SIDU now works as one unit under the leadership of one IRS reporting to the DDG-R with a single team of NRS and a single budget. The unit is linked to GR, IAP, RFWS and TES and to regional offices.

The three main activities of the unit are:

- Inspection of incoming and outgoing seed
- Preparation and distribution of seed
- Data management

In the first, introduced seed is inspected for diseases and pests, and also for unintended presence of GMOs if seed originates from a country where GMO varieties of these crops have been commercially released.

Preparation and distribution of seed includes washing and chemical treatment of seed, followed by packing and distribution. The current operation is labour intensive. There is a plan for automating seed packing and chemical treatment; washing is more difficult to automate. The advantages of automation would be overall reduction in operating costs, increase in the skill level and safety of staff involved, the demonstration of cutting edge technology to national programs, and making operations more timely. The total cost of automation would be about US\$ 60-90,000.

Data management involves production of field books for international nurseries, data collection, validation and analyses, and webpage administration. The SIDU website was launched recently and now seed may be ordered electronically. Currently there are three databases from IWIN, IMTU and SHU. The SIDU database plans to consolidate these databases by the end of 2005. Timely analysis of international nursery data is also important.

The Panel sees the urgent need for automating seed packing and chemical treatment in SIDU to improve its cost efficiency, and a need for the unit to develop a unified database system.

## **5.5 Biometrics**

The Biometrics Unit is a small specialized unit consisting of an experienced leader and three staff, one supported on unrestricted funds and two on restricted or project funds. The unit provides consulting services to research programs as well as conducting biometrics research. The bulk of its work is in the provision of services in both the design of experiments and the analysis of results, principally for wheat and maize breeding, the genebank and the germplasm enhancement activities in the GRP.

Research activities are primarily conducted with the plant breeding groups in a number of areas including genotype/environment interactions and with ITA in poverty mapping in Mexico. In the latter studies, eleven target groups of poor farmers have now been identified. The primary data for the mapping comes from the Mexican Statistics Bureau.

Outputs of the unit include:

- New statistical methods for interpreting QTLxE interaction incorporating environmental variables
- New statistical clustering method for classifying genebank accessions, assessing genetic diversity using phenotypic and molecular marker data
- New statistical genetic methodology for regenerating and collecting genetic resources
- Statistical methods for normalizing cDNA microarray experiments
- Statistical methods for assessing gene x condition interaction in cDNA experiments
- New statistical methods for studying crossover genotype x environment interaction
- Mixed linear model for predicting breeding values of self-pollinated species

The Biometrics Unit has long been an important service unit underpinning CIMMYT's research. The Panel was impressed with the dedication of the Unit's staff and the high quality of its research.

## **5.6 Soils and Plant Analysis Laboratory**

The Soils and Plant Analysis laboratory serves all CIMMYT programs. The number of samples analyzed per year is about 1,500 for soil analysis and 12,000 for plant analysis. Soil analysis is conducted mostly for samples taken in projects in Mexico whereas plant analysis is conducted for samples from different countries.

Soils analysis includes determination of pH, various elements (N-total, ammonium and nitrate, C, P, K, Ca, Mg, Na, Fe, Mn, Zn, Cu, B, and Al-exchangeable), organic matter, cation exchange capacity, electrical conductivity, moisture content, bulk density, soil texture-particle size, field capacity, permanent wilting point, and microbial activity. Plant analysis includes determination of moisture content, ash content, various elements (N-total and nitrate, C, P, Ca, Mg, K, Na, Fe, Mn, Zn, Cu, B, Al and S), total reducing sugars and amino acids. There is an emphasis on analysis of content amino acids and lipid of QPM and high oil populations of maize.

The main equipment used in the laboratory consists of an Inductively Coupled Plasma Optical Emission Spectrometer for determination of minerals, Flow Injection Analysis for ammonium and nitrate analysis, flash combustion (N/C) for N and C determination, autoanalyzer (Technicon) for N, High Performance Liquid Chromatography for determination of amino acids, carotenoids and vitamins, carbohydrates, fatty acids and pesticides.

Analytical quality is maintained through a sample exchange service within the Soil Science and Plant Nutrition Laboratory, University of Wageningen, the Netherlands. New areas of service being developed and provided by the Soils and Plant Analysis Laboratory are pesticide analysis for environmental contamination in soil, plant and water samples. The laboratory also provides training for CIMMYT and affiliated scientists.

Overall the Panel felt the laboratory provided an efficient and effective service to the CIMMYT programs that need its services.

## **5.7 Transgenic Crops and Biosafety**

CIMMYT carries out research into transgenesis and transgenic technologies in both wheat and maize. In some cases this research is targeted at the production of commercial transgenic cultivars (GMOs) with desirable traits introduced from unrelated organisms (for example Bt maize with resistance to stem borer and DREB genes for drought resistance in wheat), in other cases transgenesis is used as a sophisticated tool in genetic studies. However, the development and release of transgenes or GMOs into the environment is a matter of controversy and concern world wide. This is especially true in Mexico where there has been considerable controversy surrounding the contamination of traditional landrace varieties of maize still used by smallholder farmers by transgenes from imported seed.

CIMMYT established a Biosafety and Bioethics Committee in 1994 to advise the DG on all aspects of the safe development, growing, and disposal of products involving recombinant DNA, including GMOs. The Center also established a set of biosafety guidelines approved by the CIMMYT Board, which were in accordance with the policies and principles outlined in the "CGIAR Guiding Principles for the Development and Deployment of Genetically Engineered Crops." The Center also appointed a Biosafety Officer whose prime role is to monitor CIMMYT's biosafety facilities and application of the approved guidelines. Procedures have also been established to ensure that accessions in the CIMMYT genebank remain free of transgenic contamination.

The Panel concluded that CIMMYT has comprehensive biosafety procedures in place at El Batan, in its other research stations in Mexico, as well as the other countries in which it works such as Kenya, to minimize the risks associated with transgenic research.

## **5.8 CIMMYT Genebank**

Genetic resources are a key input into CIMMYT's maize and wheat breeding activities as a source of novel gene and gene combinations as well as its molecular biology research program. The Center has built up impressive collections of both crops over the years – in the case of wheat and triticale the number of accessions exceeds 120,000 and for maize 25,000. These accessions are housed in the Wellhausen-Anderson Plant Genetic Resources Center which was inaugurated in September 1996. This Center has a storage capacity of 450,000 samples. It also has specially designed seed treatment and packaging installations to support CIMMYT's activities in germplasm collection, conservation, seed testing and distribution. Active collections are maintained at +3°C to +5°C, ensuring seed viability for 25+ years while base collections are kept at -18°C ensuring seed viability for 50+ years. The active collections are used to service germplasm requests both internal and external while the base collections primarily serve for long-term conservation.

Until the restructuring of the CIMMYT research programs, the wheat and maize programs maintained separate genetic resource/genebank activities. This arrangement allowed for tight linkage between the breeding programs in the two crops and the genetic resource activities. However, it meant that genetic resources activities were usually regarded as a lower priority than crop improvement. It also led to lack of coordination in the Centers genetic resources program and duplication of a range of activities including data management. Under the new program structure, for the first time, CIMMYT has made a commitment to develop an integrated CIMMYT genebank operation covering wheat and maize and their near relatives with a comprehensive, fully documented and conserved set of accessions. Further, that the CIMMYT genebank will develop strong working linkages to wheat and maize genebanks in both developing and developed countries as part of a global network. The Panel congratulates the Center on this initiative and its commitment to overcoming some of the persistent operational problems in the genebank, including significant backlogs in the regeneration of wheat accessions and data uploading into the data management system. However, as noted by the CCER of CIMMYT's Wheat Breeding Activities there is an urgent need to upgrade the data acquisition, data management and genebank user interface through investment in information systems. The EPMP Panel wholly endorses this finding.

*The Panel recommends that the data acquisition, data management and genebank user interface be upgraded in the CIMMYT genebank for both wheat and maize as a matter of urgency.*

## 6 QUALITY OF SCIENCE

In this Chapter the Panel examines the quality and relevance of science at CIMMYT. The Panel considered the various mechanisms the Center has in place for monitoring, maintaining and enhancing science quality and productivity at CIMMYT against four components of the research process:

- Research relevance
- Research inputs including staff and infrastructure
- Research execution including interactions with research partners
- Research Outputs

It then used the evaluation of these components, as well as the assessment of research accomplishments of CIMMYT over the last 7 years (Chapter 3) and the new research programs (Chapter 4), to form an overall view of the quality of science at CIMMYT.

### 6.1 Research Relevance

Research relevance is determined principally by the quality and effectiveness of the strategic planning, priority setting and resource allocation processes adopted by the Center. For CIMMYT these processes have been described and evaluated in Chapter 2. The Panel concluded that the processes underlying CIMMYT's most recent strategic plan were thorough, inclusive of CIMMYT stakeholders, systematic, and well documented. However, the strategy produced from this process suffered from a number of major deficiencies. In particular, it failed to clearly identify CIMMYT's goals and their areas of comparative advantage in wheat and maize research targeted at reducing poverty. It also commits CIMMYT to a very broad research agenda well outside its traditional areas of expertise and it lacks detail on future research priorities for the organization. It has been described as more of a compass than a roadmap, but it is a compass that points in many directions simultaneously.

Nevertheless, it was also clear to the Panel that in implementing its new strategy and structure CIMMYT has been working hard to refocus its research efforts in line with its six new Research Programs and their stated goals. It was also clear that this was a work in progress as the last of the newly appointed Program Directors took up his post at CIMMYT during the main phase of this EPMR in February 2005. The Panel appreciated that significant progress was being made to implement the new research program but felt it was too early to judge the effectiveness of this process. It has therefore suggested a mid-term review in 2007 aimed specifically at assessing the progress towards the implementation of the new research programs and strategy and their effectiveness in delivering the targeted outputs and outcomes (see Chapter 2).

### 6.2 Research Inputs

#### 6.2.1 Staff

Staff are a critically important input into CIMMYT's research program. A first step in assuring staff quality is the hiring and retention of well qualified people who are leaders in their fields, or have the potential to develop into such. CIMMYT is in the process of

developing a new set of personnel policies which are under consideration for implementation at all sites at which it operates (One Staff Policy), which include a set of open and transparent processes for the employment of new scientific and technical staff. However, as noted in Chapter 9, the Panel was concerned with the potential adverse impact on staff quality of the practice of first advertising IRS vacancies internally, and only advertising externally if no suitable candidate is found. It is suggested that such positions be advertised internally and externally simultaneously and the best candidate selected for the position from amongst both sets of applicants.

Overall the quality of staff at CIMMYT is good to very good. The indicators of quality on which this statement is based includes publications, both refereed and non-refereed, student supervision, editorial memberships, honours and prizes (for the period 1990-2004 irrespective of employer) and the numbers of successful grant applications. In its assessment the Panel considered professional staff at CIMMYT during the review, including new appointees in early 2005. Ninety four percent of the current professional research staff hold PhDs and a further four per cent have MSc degrees or their equivalent. The last five years have seen significant staff changes with 66 departures and 55 arrivals in IRS (compared to a current staff complement of 87). Of professional staff currently at CIMMYT, about 4 % joined in the 1970s, 17% in the 1980s, 33% in the 1990s, and 46% in the 2000s. Of this last group 53% (26 staff) have joined since 2004. The new staff in senior positions are of excellent quality suggesting that CIMMYT, despite the changes that have occurred in recent years, is still highly regarded as a place to work. Despite the high turn-over, CIMMYT retains a healthy mix of mature and young scientists in terms of degree. Some 22% of research staff received their PhD within the last 5 years, 46% in the 1990s and the rest of those considered before that. Nevertheless in some critical research areas such as wheat breeding there are now very few experienced staff to mentor and train new younger staff arrivals and this may pose a serious problem for CIMMYT if these staff depart the organization (see Chapter 4).

A second important step is the retention of good staff and the maintenance of staff morale. Here CIMMYT has been far less successful in managing the impact of the recent changes in the organization. A staff survey conducted by the EPMR indicated that over 70% of responding staff thought that morale was poor. While widespread morale problems are perhaps understandable given the staff downsizings in recent years and the uncertainty created by such factors as the development and implementation of the new strategic plan and the proposal for a stronger IRRI-CIMMYT alliance, if they continue they will certainly impact on CIMMYT's capacity to attract and retain good staff.

A third important step to ensuring quality staff is the provision of training courses so that individuals at all levels can upgrade their skills in a supportive learning environment. While CIMMYT has provided some limited courses for staff in computing and biometrics in the past, in recent years staff training has virtually ceased. The Panel understands that scientists are not routinely offered the opportunity to attend conferences or to acquire new skills in overseas laboratories. While it is accepted that the financial constraints on CIMMYT are severe, the Panel believes this practice is short-sighted especially with the stronger focus at CIMMYT now on postdoctoral staff and the rapid advances occurring in the areas of science of primary interest to CIMMYT. The Panel **suggests** that CIMMYT management should look

at the introduction of a structured staff development program particularly for, but not necessarily limited to, younger newly appointed staff.

### 6.2.2 Research Infrastructure

CIMMYT has a strong research infrastructure principally at its Headquarters at El Batan, but also at several field stations in Mexico, and a number of external sites overseas. The Center has in place clear processes for the allocation of space, experimental facilities and land which seek to ensure that new and existing staff have the capacity to meet their agreed outputs in the rolling MTP. Several major components of CIMMYT's research infrastructure and support services were described and reviewed in Chapter 5. Overall the Panel found the quality of these services and facilities to be satisfactory, although a number of specific deficiencies were noted (see Chapter 5).

However, there were two broader issues of concern to the Panel both related to the reduction in capital spending by the Center due to the severe and ongoing financial crisis over the last five years. The first is a significant decline in the maintenance of fixed assets such as buildings including laboratories and the inability to replace key laboratory and field equipment. CIMMYT has been successful in attracting additional funds from a local farmers cooperative in Mexico to help replace and renew equipment critical to its crop improvement programs at its five field stations in the host country. In the most recent MTP the Center has also committed to reinvest an amount equal to its depreciation expense in the maintenance of its fixed asset base. However, it is likely that even with this investment, it will take several years to rebuild the general infrastructure to the level required of an international Center.

The second is the need for substantial new investment in biotechnology and bioinformatics, including institution wide data management. There are three areas where substantial new investment is required:

- High throughput molecular marker facilities. CIMMYT currently has the capacity to generate 60-70,000 data points per year. The Center needs to increase its capacity in this area by at least an order of magnitude, and preferably to a million data points a year, if it is to meet the increasing demand from the wheat and maize breeding groups as well the GRP in the near future. Otherwise CIMMYT will become uncompetitive in this area compared to other Centers and ARI's.
- Bioinformatics capacity. Clearly if CIMMYT is to generate a million data points a year it needs the capacity to capture, store, and analyze this information.
- Greenhouse and field facilities for transgenic research. CIMMYT's current facilities for the screening of transgenics are very limited and will need to expand to facilitate increased research in this area.

Clearly CIMMYT is unlikely to be able to make such large and critical investments from traditional sources of funds over the next few years while it is building up its depleted capital reserves. The Panel therefore strongly **suggests** that CIMMYT develop a detailed plan which highlights the levels of investments it needs to remain competitive in these areas of research and uses this plan to seek additional capital support to implement this plan.

## 6.3 Research Execution

### 6.3.1 Internal Quality Assurance Processes

Program Directors and Disciplinary Group Leaders have primary responsibility for the quality of ongoing research in their portfolios on a day-to-day basis which they undertake through regular monitoring of the projects and staff for which they carry responsibility. This monitoring process relies on a number of different mechanisms including:

- Regular meetings of the CIMMYT Research Committee
- An annual work planning and priority setting process at the Program level
- Annual staff performance appraisals
- Monitoring and oversight by the Program Committee of the Board
- Center Commissioned External Reviews (CCERs)

In the past the Research Committee met monthly to assess the research portfolio of the Center and to approve new projects. However, with the implementation of the new strategic plan the leadership, composition and function of the Research Committee has changed. The Research Committee is now chaired by the DDG-R and includes both the Program Directors and the Discipline Leaders. The Research Committee meets twice a year and the Management Committee four times to review CIMMYT's project portfolio and to assess opportunities for new project proposals. To date the new committee has had only two meetings and has focused strongly on the implementation of the new research matrix. It was difficult to assess, on the evidence available, the likely effectiveness of the new committee in monitoring research quality, except to note that similar committees are reasonably effective in other Centers.

In the past all CIMMYT IRS and postdoctoral fellows came together to participate in a week-long research and planning meeting which reviewed past performance and considered future priorities. Again this has changed with the implementation of the new research program. In the future, each program will conduct an annual program meeting in September/October to review progress and priorities at program level. The information from each program will be fed to the Research Committee which will be responsible for distilling out of the six meetings the overall institutional research priorities. The planning and prioritization and budget allocation process at both the program and Center level in the last year was largely *ad hoc* and, as noted in Chapter 2, the Panel **suggests** that a more objective, robust and congruent process for setting priorities and allocating resources to activities and outputs be developed and used at CIMMYT.

To track and manage staff performance CIMMYT has in place a staff appraisal process for scientific and technical staff. In the past this was done on a one to one basis between the staff member and their immediate supervisor against an agreed annual list of tasks and/or outcomes. Unfortunately variability in this process across the Center meant that it lost credibility with IRS. In the last year the process was strengthened so that IRS are evaluated by a panel consisting of their immediate supervisor, the Program Director, the disciplinary leader and, in this year, the DDG-R. Despite the changes the majority of staff surveyed by the EPMR thought the performance evaluation process was of little value in improving their job performance. Clearly CIMMYT needs to improve the process further if performance

evaluation is to be a useful tool in encouraging staff to feel valued and to improve their performance.

In the final analysis, the Board of Trustees, through its Program Committee is responsible for ensuring the quality of science. The Program Committee reviews the scientific work of the Center on a rolling basis and can make critical input into the conduct of the research programs. However, the Panel detected significant frustration on the part of some members of the Program Committee who felt their inputs were largely ignored. This issue reflects the difficulty of having trustees on the Board with high level scientific expertise and then confining their contributions to questions of high level policy. This issue and possible solutions are considered in Appendix VII.

### **6.3.2 External Quality Assurance Processes**

Several external quality assurance processes are used by CIMMYT to monitor and maintain the quality of its science including reviews by donor agencies, systemwide reviews conducted by the CGIAR, review of the MTP by the Science Council and CCERs.

Reviews by donor agencies are one of the most effective, but least appreciated mechanisms in the CGIAR, for maintaining the quality and focus of science in the Centers. Donors often review projects funded by restricted funds on a regular basis and since an increasing proportion of the Centers activities are funded in this way, it means they are routinely subject to external review. In CIMMYT's case 3-4 donor agencies have reviewed projects in the Center each year over the last five years.

Two systemwide reviews were available to the Panel for its consideration in evaluating the quality of science at CIMMYT. The first was the CIMMYT Sub-Panel Report of the Systemwide Review of Plant Breeding Methodologies in the CGIAR undertaken in February 2000. The first term of reference for this review related to the assessment of the effectiveness of the breeding technologies in use at CIMMYT particularly in relation to molecular technologies. Overall the review reported very favourably on the quality of the breeding programs at CIMMYT at the time and their adoption of appropriate new technologies. However, the rate of advance in molecular technologies is so great that the review has only limited relevance today.

The second was the review of the Ecoregional Program entitled the "Rice-Wheat Consortium for the Indo-Gangetic Plain (RWC)" undertaken in March 2003. The review Panel concluded that the RWC had been a successful joint venture between CIMMYT, IRRI and NARS that served as an innovative model for regional and international cooperation with a credible record of scientific and practical achievements.

#### **6.3.2.1 CCERs**

CCERs were introduced in the CGIAR in 1995 to improve the quality and consistency of EPMRs by, in part, providing additional information on the quality and relevance of science in the Centers. Since the time available to EPMRs is limited, CCERs were seen as a way in which Centers could audit the quality and relevance of science for their own purposes, and meet the CGIAR's requirements for independent external evaluation of Centers' science.

CIMMYT has initiated only two CCERs since the last EPMR in 1997 of relevance to the quality of science in the Center. The first was on CIMMYT's Wheat Breeding Activities conducted in March 2004. The second was on CIMMYT's Maize Improvement Program in SSA conducted in May 2004. The major findings of these CCERs are discussed in Chapter 3. What is important here is that both CCERs explicitly examined the quality and relevance of CIMMYT's science in relation to wheat improvement worldwide and maize improvement in SSA. Both CCERs were conducted by distinguished panels of international experts and were well timed in relation to the EPMR and helpful in assessing the quality of the programs reviewed. Both provided very strong support for the quality and relevance of CIMMYT's science as well as suggestions as to how what are excellent programs can be further improved. The Panel **suggests** that CIMMYT conduct further reviews particularly in relation to economics and biotechnology to strengthen the monitoring of the quality of science in these areas and facilitate the Centers ongoing strategic planning process.

### **6.3.3 Interactions with Partners**

The capacity of CIMMYT to have impact and achieve its goals is heavily dependent on forming partnerships with those who have complementary capacities, ARIs upstream and NARS and NGOs downstream. Such partnerships will become even more important as CIMMYT implements its new strategic plan, and they are increasingly recognized as a key element of the Center's capacity to achieve its strategic goals. As noted in Chapter 7 CIMMYT has a wide range of partners and partnerships which vary greatly in their effectiveness. There has been little systematic attempt by the Center to routinely assess the quality and its effectiveness of its partnerships. However, the wide ranging survey of CIMMYT's partners conducted as part of the strategic planning process does provide some useful insights on this point. This survey found that CIMMYT has a rich and extensive network of interacting partners but was often regarded as a poor collaborator in that its staff were often too busy to nurture relationships. This will be an issue for CIMMYT in the future as it proposes to expand its partnerships to assist in achieving its goals. The Panel **suggests** that CIMMYT needs to look critically at the quality of its partnerships in implementing its new strategic plan.

## **6.4 Assurance of Research Output Quality**

CIMMYT has a range of processes in place to ensure the quality of its research outputs. These include external reviews such as CCERs and donor assessments of projects, impact and adoption studies and feedback from partners, both ARIs and NARS.

Publications are one important output from a scientific organization and the number and quality of publications is a key element in IRS staff appraisals at CIMMYT. A structured internal refereeing process administered by the DDG-R is used to monitor the quality of papers produced by CIMMYT scientists. CIMMYT has well developed processes in place to record and assess publication outputs.

However, the Center is far less effective in recording and assessing other useful products derived from its research as a measure of the quality of the research output both of the scientists individually or the institute as a whole. These research outputs include improved germplasm and finished cultivars, new scientific methodologies and farm practices amongst

others (for assessment of outputs see Chapter 3). Even though these are said to be recorded as part of the annual evaluation of the individual scientists there does not seem to be a formal process at the institutional level to record and document such products. CIMMYT does keep a good record of the use of the improved germplasm it develops in further varietal development by both developing and developed countries. However, this is the exception rather than the rule which makes the use of research products other than publications in the evaluation of the quality of research difficult.

## 6.5 Overall Quality of Science

Assessment of the overall quality of science undertaken in an organization is complex. First, because such assessments are relative, they need to be done through comparison with appropriate comparator organizations. Choosing appropriate comparator organizations to Centers such as CIMMYT is difficult not only because of the wide range of scientific research undertaken but because it is undertaken in many places through a multiplicity of collaborative arrangements. Second, even if a suitable comparator is available it is often difficult to obtain comparative data on the two organizations. Third, there are few agreed criteria for measuring quality of science.

As a first step in assessing the quality of science at CIMMYT the Panel examined the publications by individual professional staff members in refereed international journals over the past 6 years (irrespective of employer) and compared it to IRRI as a comparator organization as well as ARIs in developed countries. We used this approach because publications in refereed journals are a widely accepted international indicator of science quality. IRRI was chosen as the primary comparator because its research broadly parallels that undertaken by CIMMYT and data are readily available in IRRI's 2004 EPMR. In analyzing the publication data for CIMMYT, the Panel considered only IRS (including postdoctoral fellows, associate and adjunct scientist) who allocate more than 10% of their time to research, since this was the criteria used in the IRRI EPMR (Figure 6.1).

It is overall clear that IRRI staff had a higher publication rate than CIMMYT staff in recent years (2 peer reviewed journal articles per year versus little over 1.4, with the exclusion of one new CIMMYT staff member who published some 15 refereed journal articles per year from the analysis of the publication mean) although the time period is slightly different. More staff at CIMMYT published less than one paper per year than at IRRI, some of these were undoubtedly postdoctoral fellows early in their career. Even if staff that have their PhDs since 2000 are excluded from the data, the average number of publications in refereed journals by CIMMYT scientists only increases from 1.4 to 1.6 per year. If peer reviewed books and book chapters are included in the data the difference between the two Centers widens to 3 for IRRI and 2.2 for CIMMYT. The publication rate at IRRI would be regarded as intermediate to good for scientists working in developed country institutes so that CIMMYT staff fall a little below that mark. Other criteria of science quality assessed were percentage of staff participating in student supervision (57% for CIMMYT and 75% for IRRI) and serving on editorial boards of journals (20% for CIMMYT and 40% for IRRI).



farming in harsh environments CIMMYT has no peer. In this sense the quality of science at CIMMYT is outstanding.



## 7 PARTNERSHIPS AND LINKAGES

### 7.1 Interactions with Other CGIAR Centers

#### 7.1.1 Systemwide Programs

CIMMYT is involved in four systemwide initiatives: the Rice Wheat Consortium (RWC) and three CPs. The RWC is the longest standing of these and was originally a joint program between CIMMYT, IRRI and four regional NARS (India, Nepal, Bangladesh and Pakistan). The membership of the RWC has grown over the years to include a range of other CGIAR Centers, NARS, ARIs and NGOs and it has attracted, and continues to attract, strong support from a wide range of donors. CIMMYT assumed responsibility for the management of the RWC in 1998 and since that time the consortium has functioned well and had a very significant impact in terms of conservation farming in the rice/wheat growing areas of the IGP (see Chapter 3). As a result it is widely regarded as a useful model for ecoregional programs in the CGIAR, and the Panel congratulates CIMMYT on its role in this successful consortium.

CIMMYT is the convening Center for the Genetic Resources CP (Generation CP), and is a partner in the CP on Water and Food and the Biofortification CP (HarvestPlus). While it is too early to judge the utility and impact of the CPs in relation to CIMMYT, it is clear that the Centers, by acting collectively, have attracted stronger support from a range of partners, particularly in the private sector, than they could have individually.

#### 7.1.2 Inter-Center Interactions

In addition to the systemwide activities discussed above, CIMMYT is involved in a large number of bilateral or multilateral collaborative activities with other CGIAR Centers. The Panel solicited responses from the DGs of all the CGIAR Centers on the value and effectiveness of these activities and found they were generally supportive. However, there are areas for concern and the Panel explores these in more detail below.

##### 7.1.2.1 CIMMYT-ICARDA Relationship

CIMMYT and ICARDA have joint responsibility for wheat improvement in the CWANA region. This overlapping mandate has on occasion caused significant tension between the two Centers. As a result, a series of agreements were negotiated in 1996, 1997 and 2002, which outlined the scope, mode of operations and financial commitments of the two Centers to joint breeding programs for spring bread wheat, durum wheat, and facultative and winter wheats, and which were designed to optimize delivery to NARS, exploit synergies and avoid duplication. Collaboration between the Centers up until 2003, while not perfect, was effective and the joint CIMMYT-ICARDA wheat breeding activities were delivering significant benefits to the region. However, in 2003 CIMMYT terminated the employment of its two breeders located in ICARDA as the result of the downsizing of the wheat program. The two breeders were subsequently rehired by ICARDA which assumed prime responsibility for spring and bread wheat breeding for the CWANA region. This left the joint winter/facultative wheat breeding program with Turkey, and located in Ankara, as the only joint program in the region. As a result of these events, as well as the changes outlined in the CIMMYT strategic plan for its activities in the CWANA region, which appear to duplicate ICARDA's activities on feed/livestock integration, management of scarce water resources,

reduction of land degradation and diversification through pulses, rekindled past tensions. Again a series of meetings have been held to resolve these tensions and to establish new working relationships in a range of areas in the region. The Panel applauds this development but **suggests** that CIMMYT in the future needs to establish an ongoing high level dialogue with ICARDA to prevent these periodic and damaging disagreements.

#### *7.1.2.2 CIMMYT-IRRI Relationship*

As noted in Chapter 1, IRRI and CIMMYT have explored over the last two years a series of options ranging from complete amalgamation of the two Centers to form an international crops research institute to greater interaction in specific areas of research. At the end of the day, the two Centers chose to further their interaction in four specific areas including intensive cropping systems particularly rice-wheat and rice-maize cropping systems in South and Southeast Asia (building on their long and successful collaboration in the RWC), crop information systems, training and knowledge banks for the worlds three largest crops, and climate change research aimed at mitigating and adapting rice, wheat and maize to climate change. They also agreed to share a range of support services to increase operational efficiencies. Comment from some of CIMMYT's stakeholders suggest that many were disappointed at the outcomes generated by what was a relatively long and expensive consultation process by the two Centers, particularly in relation to what was possible. It can be strongly argued that the areas of cooperation identified were already well developed (intensive cropping systems) or where cooperation between Centers in the CGIAR System should be automatic (training and knowledge sharing), or represented new areas of research where neither Center had particular skills (climate change). There was no mention of three important areas of research - genetic resources, genomics and bioinformatics - which were originally identified as prime areas of interest, and where both IRRI and CIMMYT have recognized strengths and weaknesses and joint activities appeared to offer significant benefits. The Panel acknowledges that the CIMMYT Board was forward looking and innovative in their approach to strengthening the alliance between IRRI and CIMMYT and used a thorough and professional process to examine the strengths and weaknesses of the options proposed. Nevertheless, the result at the end of the process was less than expected and is likely to add further pressure for externally driven changes to the CGIAR System.

#### *7.1.2.3 CIMMYT-IITA Relationship*

CIMMYT and IITA developed to an effective but limited relationship towards the end of the 1990's, when both Centers agreed to share the maize improvement mandate in SSA: IITA for West and Central Africa, and CIMMYT for eastern and southern Africa. As a result the following joint projects were undertaken: 1) The Development and Promotion of Quality Protein Maize in Sub Sahara Africa; and 2) Developing and Disseminating stress tolerant maize for sustainable food security in West, Central and East Africa (AMS Project). Overall the relationship between CIMMYT and IITA remains sound but limited, and with CIMMYT's new commitment to regional programs, particularly in Africa, and to improvement of livelihoods, it is a relationship that will require further development in the near future to avoid the sorts of problems that have developed in the CWANA region.

### **7.1.3 Overall Assessment of CIMMYT's Interactions with other CGIAR Centers**

The above discussion underlines some of the strengths and weaknesses, as well the diversity and depth, of CIMMYT's interactions with its sister Centers in the CGIAR System. To better

assess how well CIMMYT interacts with its partners in the CGIAR System the Panel examined the joint publication record between CIMMYT scientists and their peers in other Centers. It was reasoned that, since science to assist development and poverty reduction is the core activity of the CGIAR Centers, then interaction between the Centers would be reflected in their joint scientific outputs - in this case specifically, joint publications in refereed journals. The results of this analysis are shown in Table 7.1.

About 6 percent of the 388 papers published in refereed journals by CIMMYT scientists were co-authored by peers from other Centers. The figure varied markedly between the different areas of research and was highest for NRM and lowest for the biotechnology group. The largest number of papers (8) was published with IRRI scientists, all but two from work in the RWC. There were just two joint papers in other areas of research despite the wide range of activities IRRI and CIMMYT have in common. Scientists from ICARDA and CIAT were co-authors in five papers, IFPRI in two and scientists from ICRISAT, IPGRI, ILRI and IITA in one each. All in all these data suggest the level of scientific interchange between CIMMYT and other Centers, outside the systemwide initiatives, is limited despite significantly overlapping mandates.

**Table 7.1 CIMMYT Publications by Program with Other Centers**

	1999	2000	2001	2002	2003	2004	Total
<b>Maize Program</b>							
Peer reviewed publications	9	10	11	15	17	7	69
Jointly with other Center (CIAT, ICARDA)	1				3		4
<b>Natural Resources Program</b>							
Peer reviewed publications	3	0	2	7	7	3	22
Jointly with other Center (IRRI)	1		1	1	1	1	5
<b>Economics Program</b>							
Peer reviewed publications	2	7	7	5	15	4	40
Jointly with other Center (CIAT, ICRISAT, IFPRI, IPGRI)					2	1	3
<b>Biotechnology Group</b>							
Peer reviewed publications	12	4	9	13	12	15	65
Jointly with other Center (IITA)	1						1
<b>Wheat Program</b>							
Peer reviewed publications	20	25	33	28	46	40	192
Jointly with other Center (ICARDA, CIAT, IRRI, IFPRI, ILRI)	2	2	2	1	1	1	9

## **7.2 Links with NARS and NGOs**

The consultations and analyses that underpinned the development of CIMMYT's new strategy identified the Centers extensive networks and partnerships as one of its strong scientific and operational strengths. CIMMYT currently operates through 15 regional offices in Africa, Asia, CWANA and South America. Through these regional offices CIMMYT has established a rich diverse set of interactions with developing countries where wheat and maize are important crops or are of increasing importance in meeting farmers' needs for more sustainable and profitable cropping systems. These interactions include both bilateral arrangements between individual NARS and CIMMYT, or increasingly, through networks. The Center initiated, and/or participated in, a number of effective and successful Networks for Asia and Africa with global spill-over. These networks have an extensive number of partnerships from NARI, NGOs, Private Sector, CGIAR Centers, and others. The goal of these networks is to improve access to CIMMYT's research outputs by resource-poor farmers. A number of the major networks are described below.

### **7.2.1 Asian Maize Biotechnology Network (AMBIONET)**

Based in the Philippines, AMBIONET was launched in 1998 as a participatory forum to facilitate the use of biotechnology to catalyze increased maize productivity in Asia's developing countries. A central principle of the network is collaboration and information sharing among its members from Asian NARS. CIMMYT provides technical training, backstopping, and guidance.

This network, which is about to complete its second phase (February 2005), had targeted genetic fingerprinting and mapping activities in support of breeding of QPM, drought tolerance, genetic diversity, and resistance to banded leaf and sheath blight (an emerging threat in intensive maize/rice cropping systems) as major activities. These objectives were supported with training.

### **7.2.2 Insect Resistant Maize for Africa (IRMA)**

Maize is a major food crop in Africa and threats to this food source endanger food security. Stem borers pose such a threat in much of Africa. In Kenya alone, farmers report losing 15% of their maize harvest to stem borers, equivalent to 400,000 t of maize valued at US\$ 40 million.

To tackle this problem, the IRMA project was launched in 1999 by the CIMMYT and KARI, with financial support from the Syngenta Foundation for Sustainable Agriculture. The project is aimed at producing maize that is adapted to various Kenyan agro-ecological zones with resistance to the insect pests *Chilo partellus* and *Chilo orichalcocillielus*. Both conventional and biotechnology-based sources of resistance are being examined for their effectiveness against the borers. Major project objectives include environmental and socioeconomic impact studies, resistance management strategies, and project documentation. Based on the experiences and results generated in Kenya, appropriate technologies and varieties will be extended to other African nations. From 1999-2004, US\$ 7 million was spent on the Bt project, while only the amount of US\$ 0.5 million was invested in the host plant resistance work.

The outputs of the project include: maize inbreds, hybrids, and open-pollinated varieties that combine conventional and biotechnology-based insect resistance; protocols developed and KARI scientists trained in the development, evaluation, dissemination, and monitoring of insect resistant maize; economic analyses to determine farm-level profitability, farmers' willingness to pay for the technology, and the overall private and public benefits of the technology; insect resistance management strategies; practical experience for KARI staff in biosafety and IPR procedures in Kenya; and documentation of experiences on development, dissemination, and impacts of gene-based resistant maize germplasm.

### **7.2.3 The Southern African Drought and Low Soil Fertility Project (SADLF)**

SADLF is a collaborative effort between CIMMYT and national agricultural research systems of the Southern Africa Development Community (SADC) region. Begun in 1996, SADLF is funded by the Swiss Agency for Development and Cooperation and the Rockefeller Foundation. The Project aims to improve the food security and incomes of resource poor-farmers in southern Africa by (1) developing and disseminating high-yielding, drought tolerant maize varieties; (2) changing the way maize cultivars are developed in the region; empowering farmers to tell the research sector and the seed producers what kind of cultivars they want; and establishing effective links with seed dissemination.

The project brought together the efforts of more than 30 core-participants, over 50 institutions, and more than 1,000 farmers in approximately 100 farming communities. To verify the performance of the best varieties under farmers' conditions and to ensure that seed becomes available quickly, the project designed a novel, cost effective, farmer-centered varietal testing approach. Known as "mother-baby" trials, it involves sets of experiments grown by researchers, NGO and extension staff, and farmers under both controlled and farmer managed conditions. This method allows up to 30 farming communities in a country to assess promising new maize varieties, with the help of partner organizations. Information on farmers' opinions of the varieties and data on their performance flows back to researchers, NGOs, extension, and seed companies, increasing the chances that farmers will get access to the kind of seed they want. Today, mother-baby trials are coordinated by national programs in Angola, Botswana, Lesotho, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe, in southern Africa. Several hundred researchers, extension, and NGO staff have been trained and are being involved in the mother-baby trial approach in the SADC region alone. At the regional level, CIMMYT provides training, technical backstopping, breeder seed and helps to balance the build-up of supply (seed production) against demand, as expressed by farmers through the trials.

The collaborative approach of SADLF has given stakeholders and farmers the power to influence breeding priorities, to apply diverse selection criteria for diverse purposes and environments, and to design appropriate and diverse follow-up strategies (such as community-based seed production schemes; bulk purchases of seed through farmer organizations, local partner organizations or dealers; further promotion of farmer-selected varieties through demonstration plots; etc.) that stimulate the dissemination of more appropriate and genetically diverse varieties. Improved, drought-tolerant maize from this initiative was being grown on at least 250,000 ha in southern Africa as of April 2004, and the area is increasing rapidly.

#### **7.2.4 Soil Fertility Management and Policy Network for Maize-Based Farming Systems in Southern Africa (SoilFertNet)**

SoilFertNet was launched in late 1994 in response to the need for better co-ordination of soil fertility research work in Malawi and Zimbabwe. It has subsequently expanded to Zambia and Mozambique, developed far more socio-economic work, and moved to promote technology products from research. It has brought together a critical mass of financial and human resources to help smallholder farmers in the four target countries to maintain soil fertility under serious income, land, and labour constraints and to produce higher, more sustainable and profitable yields from maize-based cropping systems.

Benefits to members include heightened awareness on soil fertility issues; access to information and training on useful methods—including crop simulation models, GIS, participatory approaches, socio-economic analysis, conservation agriculture and other good science on soil fertility and cropping systems—that might otherwise not be available to the region's specialists; soil fertility research results, including Best Bet technologies and other solutions; advice and direct assistance in mobilizing additional funds; a better likelihood of adoption of improved technologies that can improve the food security and livelihoods of small-scale farmers.

#### **7.2.5 The Development and Promotion of Quality Protein Maize in Sub-Sahara Africa**

This project started in 1998 funded by the Nippon Foundation. The objectives of the project include: Germplasm Development for the major ecologies of SSA; Germplasm Testing to identify superior germplasm and cultivars; Seed Production/Dissemination to ensure availability of seed of QPM varieties in most countries of SSA; Training of scientists, technicians, and support staff capable of sustaining QPM research and dissemination efforts in SSA; Access to laboratory facilities to facilitate QPM research in SSA; and Nutritional and economic studies to document the potential and actual and economic impact of QPM in selected countries of SSA. Since 1998, the project has made valuable contributions to the improvement of maize production and nutritive quality in SSA. Some 350,000 ha of QPM maize was planted in the region in 2004-2005.

#### **7.2.6 SADC Seed Certification and Quality Assurance Scheme**

The overall objective of this scheme is to encourage the production of quality seed of varieties listed in the SADC Common Variety Catalogue and traded among SADC countries, and that a regional market is organized where seed can move more freely from one country to another.

The immediate objectives of the system are: facilitation of the seed trade among SADC countries through regional agreed principles, standards and rules, and removal of trade barriers; increased farmers' access to quality seed; enhanced partnerships between public and private sectors and investment in the seed sector made more attractive; and strengthening of information sharing about seed production and supply in SADC.

This is a very useful scheme which has contributed to the dissemination of high quality seed to all farm areas in SADC region and accelerated the adoption of improved varieties.

### **7.2.7 The Eastern and Central Africa Maize and Wheat Network (ECAMAW)**

The participating countries in the ECAMAW network are Burundi, the Democratic Republic of Congo, Eritrea, Kenya, Madagascar, Rwanda, Sudan, Tanzania, and Uganda. Major achievements and impact in capacity building include: development of research infrastructure; farmer participatory approaches; the involvement of women; strengthening national research systems; building regional maize teams.

### **7.2.8 East and Southern African Regional Maize Nursery (REGNUR) Project**

The project allows breeders and pathologists across the region work together to improve germplasm for resistance to the major diseases. Phase I (1997-2001) covered eastern Africa alone, while Phase II (2002-2004) was expanded to include southern Africa.

The following diseases were addressed through collaborative projects with NARS: Northern leaf blight in Kenya, Malawi, Tanzania, and Zimbabwe; Common rust in Kenya and Zimbabwe; Gray leaf spot in Ethiopia, Kenya, Malawi, Tanzania, and Zimbabwe; Ear rots in Ethiopia, Kenya, Malawi, Tanzania, and Zimbabwe; *Phaeosphaeria* leaf spot in Kenya and Zimbabwe; Head smut in Kenya; Downy mildew in Mozambique; and Maize streak virus in Kenya, Tanzania, and Zimbabwe.

The following goals were accomplished: National programs were provided to a wide range of improved Germplasm; Systematic evaluation of disease resistance as an integral component of breeding; Exchange of information, selection, and use of promising Germplasm; Understanding of regional variation of maize pests; and Verification for the utility of regional breeding programs for their utility of the present screening techniques of germplasm with satisfactory disease and insect reaction.

Phase II started 2002 with a changed emphasis on collaborative maize breeding rather than collaborative germplasm evaluation. Which included the following activities: Use of maize lines with superior drought and low-N tolerance from the SADLF and AMS projects; Use of maize lines from the AMS project with superior Striga tolerance; Use of maize lines from the IRMA project with superior stem borer resistance; and Use of promising lines identified by the highland maize project to increase the genetic diversity of highland germplasm.

### **7.2.9 Building on the Regional Network**

Under the new CIMMYT strategic plan being implemented additional staff will be outposted from Headquarters to the regions, and additional emphasis will be given to the role of partnerships with NARS and NGOs involving new approaches of doing business based on equality in sharing resources, contributions, accountability and credit in all these partnerships. While this aim is highly laudable, the Panel noted that with reduced numbers CIMMYT's staff are, in some areas, having difficulty in maintaining the number and quality of their existing interactions and meeting the expectations of their partners. In future these staff are unlikely to be able, as suggested in the new strategic plan, to increase both the number and strength of their relationships with NARS and NGOs. The Panel **suggests** that as CIMMYT moves towards the full implementation of its new strategic plan, greater emphasis be given by Program Leaders to better defining those interactions that are critical to the success of CIMMYT's strategy and ensuring these are given highest priority by outposted staff.

### **7.3 Links with Advanced Research Institutes**

ARIs have been active partners and collaborators with CIMMYT and the Center has derived significant benefits from third party funded interactions with ARIs. Links with scientists in universities and research institutes offer CIMMYT the ability to participate in cutting edge research in a wide range of subject areas including molecular genetics, genomics, bioinformatics, and pathology, eliminating or reducing CIMMYT's need to make the investments in expertise or infrastructure required to be competitive. Interactions with ARIs also offer CIMMYT a way to capture in-kind contributions of equipment and facilities that may be difficult to access in other ways, in the process of strengthening collaborative projects.

ARIs were among those who flagged the difficulty of CIMMYT as a partner—principally, the constraints on staff time and an organizational culture that was not always nimble in forging or nurturing partnerships. These are critical shortcomings to address. If CIMMYT's strategy is dependent along many dimensions on sophisticated, highly strategic and advantageous partnerships, an explicit organizational value needs to be incorporated at critical points in priority setting, resource allocation and evaluation to assure that the partnership strategy is deployed. ARIs offer unique advantages to CIMMYT in the realization of its new strategy and efforts should be made analyze mutual benefits and current impediments to strengthening links with them.

### **7.4 Partnerships and Linkages with Private Sector**

The Fourth EPMR in 1997 emphasised the potential for increased interaction between CIMMYT and the private sector in broadening its funding base and improving its access to proprietary science that would be of benefit to the poor. This suggestion reflected the greatly increased private investment in agricultural research and development in the 1990s driven by the potential profits that IPR attaching to plant varieties, genes and biotechnologies could generate. It was felt that unless Centers such as CIMMYT develop better ways intersect with the private sector then the results of an increasing proportion of the global investment would not be available to resource poor farmers for decades. Since that time, CIMMYT has entered into a range of bilateral and multilateral agreements with private sector partners. The results of these agreements have varied. Most have been positive and beneficial to CIMMYT and its stakeholders. But several have been less positive but have provided a valuable learning experience for the organization. Its approach to joint ventures with the private sector is now more sophisticated than it was 7 years ago and the Center has clear policies in place to facilitate such interactions.

Overall the Panel felt that under the current management CIMMYT was moving to a balanced and judicious relationship with the private sector while in keeping with its role as an international distributor of public goods.

## **7.5 Training and Capacity Building**

### **7.5.1 Introduction**

This section looks at CIMMYT's training activities, which complement networks discussed above, in facilitating capacity building. In the period 1999-2004, nearly 7,000 people participated in CIMMYT training activities. Before the restructuring, CIMMYT's training formed one of the MTP Projects, 'Building Human Capital'. CIMMYT had a Training Steering Committee, Training Service Office and Training Officers from each program. With the restructure, CIMMYT housed its training activities within Program 2. A new Training Coordinator was hired in 2004 and CIMMYT is in the process of finalizing a new training strategy.

From 1999 to 2002 CIMMYT devoted some 14% of its budget to the training and professional development activity; a little over half of the budget allocated to its MTP Undertaking Strengthening NARS (approximately 26% of budget). Actual resource allocation figures are not available for later years, but the allocation to Strengthening NARS in 2004 is estimated to be significantly higher than in the past, at 34% of total budget going up to 40% in 2005. For 2004 and 2005 the overall activity of Training and Professional Development is estimated at 5.7% and 5% of the total budget, respectively. Both sets of figures include the Generation CP and RWC budgets and were not available for CIMMYT agenda alone. Within Program 2 there is a small operating budget (estimated at 0.7% and 0.5% of the total Center budget for 2004 and 2005, respectively) allocated to the Training Coordinator.

In the current program structure, training activities are budgeted for in all the other Programs except RFWS. This indicates that training will be highly integrated into research, which the Panel considers a good trend.

### **7.5.2 Training Outputs**

CIMMYT has provided both course and individual degree training. It has also provided advanced non-degree training for mid-career professionals both in Mexico and elsewhere and housed visiting scientists. However, the training statistics are lacking and records were not systematically kept for individual training or decentralized training. The records have been recently reconstituted and the overview below is based on these data. It is likely that the actual number of both individual and course trainees is higher than presented, particularly for training organized outside Mexico, as in-country training was not well recorded. Due to the lack of data on gender, the Panel could not assess how well CIMMYT training has reached women in developing countries.

#### *7.5.2.1 Course Training*

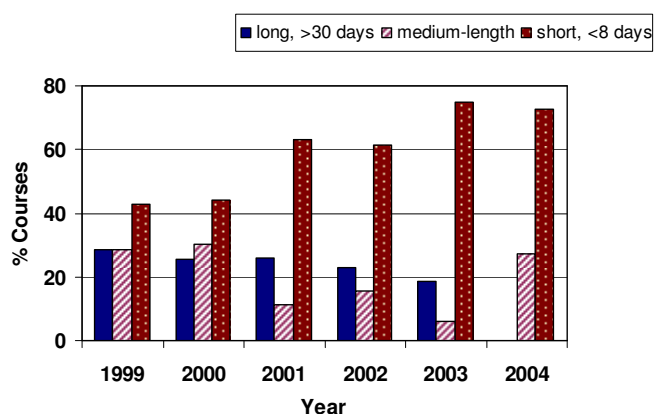
During the review period 1999-2004, CIMMYT organized some 250 courses, about 15% of them in Mexico. In recent years this proportion has gone down to 8-10%, which may reflect better data collection for in-country training, in addition to further decentralization of training. CIMMYT has held courses in 36 countries. Most of the long courses (>30 days; 60%), which are no longer organized, were held in Mexico, but some were held in Brazil, Kazakhstan, Kenya and Zimbabwe. In 1999-2003 an average of 44 courses were organized per year (the actual number may be higher), but in 1994 there were only 28 courses.

More recently, CIMMYT has also engaged in training farming families and in farmer school activities. These activities, which are probably better characterized as extension or participatory research, also contribute to capacity building but they are not included in either the data or the discussion.

CIMMYT has had a long history of organizing long term courses on wheat industrial quality (2 months), and maize and wheat crop management and breeding (3-6 months). These courses were discontinued in 2004. Figure 7.1 illustrates the strong recent shift towards shorter courses.

The most common general themes have included breeding (23% of courses), NRM (18%), crop production, participatory research methods, seed related issues, and social sciences (8-9% each), biotechnology (6%) and general methods (11%), not related to research themes, such as statistics, English language and scientific writing. Three times as many courses were devoted to maize compared to wheat.

**Figure 7.1 - Length of CIMMYT training courses**



With the trend of shorter courses, the number of training days has been reduced. Participant data are shown in Table 7.2. The total number of training days in 2004 was only 17% of the training days in the peak year (2000).

**Table 7.2 - Participants in CIMMYT courses (1999-2004)**

	1999	2000	2001	2002	2003	2004	Total
Participants	773	1282	1030	801	1979	852	6717
No. training days	19202	20768	10992	10067	7828	3680	72537

#### 7.5.2.2 Individual Training

In order to assess the individual training effort since 1999, the Panel drew from a regularly updated publication on theses that have been published following graduate studies research either at CIMMYT or with CIMMYT's financial support. In 1999-2004 155 theses (MSc, PhD and BS degrees) were published. There has been a steady downward trend over that period, as shown in Table 7.3.

**Table 7.3 – Thesis from CIMMYT supported training (1999-2004)**

<b>Thesis</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>Total</b>
BS	12	10	9	3	6	1	41
MSc	9	8	10	14	8	2	51
PhD	18	12	9	10	8	6	63
Total	39	30	28	27	22	9	155

The degree trainees came from 36 countries: 48% from Latin-America, (35% from Mexico) and 26% from developed countries. The following thesis themes were the most common: breeding and genetics (46, including studies on host-plant resistance), social science (24), plant pathology and entomology (21), NRM (16) and biotechnology (12). Some 42 theses dealt with biotic stresses and 13 with abiotic stresses, mostly drought.

### **7.5.3 Impact of CIMMYT Training**

In 2004 CIMMYT commissioned a training impacts study, which looked at impact of training over a decade, 1991-2001. The assessment was based on interviews at CIMMYT, data related to training, and perception surveys of both ex-trainees and their supervisors. The limitations of the study were recognized by the authors; the sample size for both trainees and supervisors was rather small. Also, methodologically the trainee survey was not very strong, as the response rate was rather low (30%) and there was no way to tell what the non-respondents think (and this is the most vulnerable dimension). Furthermore the responses were unequally distributed between different region, and the perceptions of African trainees and supervisors were poorly represented.

The general response from the two groups was consistent, indicating that CIMMYT training has had a positive impact both at the individual and at the organizational level. A majority of trainee respondents gave very favourable opinions about the quality of the training received and said that it improved their skills and, as a consequence, the impact on their work was a positive one. Several trainees were able to give specific examples of the ways that they had developed professionally as individuals and that research practices had changed in their organizations. Importantly individual trainees reported that the training had increased communication with international scientists. Research leaders responded in greater numbers and most of them had a very positive opinion on the impact of CIMMYT training on their research institutions.

### **7.5.4 Assessment**

Based on the information available to the Panel and the results of the impact study, albeit with limitations, the Panel concludes that CIMMYT's training has significantly enhanced the spread of its research results and technologies and contributes to changing the way of research farming practices. In order to enhance both the quality and effectiveness of its training and its ability to monitor the results, CIMMYT needs to document the activities and collect post-training feed-back in a systematic fashion, a practice that surprisingly has been missing to date at CIMMYT. Mentoring and supervision on-the-job is likely to have been, and to continue to be, an extremely important means for capacity development, the precise magnitude and impact of which the Panel had no means of assessing.

Capacity building is at the core of CIMMYT's new strategy and this will also be reflected in the training strategy, which is near completion. Yet, sustaining capacity, particularly in Africa has become increasingly difficult not least because of HIV/AIDS. The trend to incorporate training into research and further decentralize it is commendable. However, CIMMYT needs to think of innovative means both in terms of resources and strategies to secure the sustainability of its training and capacity strengthening activities in the long term.

*The Panel recommends that: a) Training coordinator position be relocated to an independent Unit reporting directly to the DDG-R; b) the Training Unit working together with Program Directors develop a priority setting tool, both thematic and geographical. The resulting priorities should then be used to allocate resource to the programs; c) CIMMYT develop innovative alternative funding schemes for training.*

## 8 GOVERNANCE

### 8.1 Background

In the interval since the last EP MR in 1998, CIMMYT has undergone a change in leadership at the level of the director general and within its Board of Trustees; it has completed a major planning process that is reshaping the way it develops and allocates its resources; it has confronted and continues to weather serious financial challenges; and it has embarked on or is studying collaborative ventures that raise potentially difficult issues of strategy, accountability and risk management. Although each of these events and circumstances requires effective management and leadership at the staff level, each also places substantial demands on CIMMYT's Board of Trustees as the legally responsible entity for the organization.

This section of the report focuses on the governance of the Center and on the intersection of the Board of Trustees with the DG and senior management staff as strategy is determined, and stewardship and accountability take place. It also looks at a pattern of failed oversight at the Board level in the interval between the last EP MR in 1998 and 2001 when the financial and leadership crisis at CIMMYT reached critical levels.

The 5th EP MR comes at a critical juncture in CIMMYT's organizational life as well as at a time when both the nature of corporate governance is evolving and the need for effective governance in every sector that depends to any degree on public trust and public accountability is more clearly valued. The issues raised with respect to CIMMYT's governance reflect both the changing demands and expectations placed on boards generally, and the particular demands that the CIMMYT Board faces.

### 8.2 The High Cost to CIMMYT of Inadequate Governance

One purpose of the EP MR is to be forward looking, making assessments and recommendations with future capacity and effectiveness in mind. Another equally important is accountability, which requires an assessment of past performance. This review includes a more substantial section dealing with governance issues than have appeared in earlier EP MRs. This should not imply that the current Board is less effective or competent in meeting its responsibilities than its predecessor Boards. Nor should the chapter be read as a critique only of the quality of governance at CIMMYT since the last EP MR, nor even of governance of CIMMYT alone. Financial problems tend to put a bright, unforgiving light on underlying and long standing inadequacies in oversight and stewardship. In this case, they also reveal the inherent and systemic problems of achieving good governance within a structure that appears designed to be dysfunctional. (Appendix VII looks at the standards and practices common within CGIAR Centers and proposes a more functional and strategic approach to Center governance.)

Good governance is a collective enterprise that depends on able people to work effectively within a framework that supports good work through structure, practice and access to information. People who in their individual capacities can be talented and expert and who bring passion and commitment to an organization (which is a fair description of the

individuals who currently serve on CIMMYT's Board) can still fail collectively as a Board to govern well.

Within NGOs, there is a disconnection between the level of responsibility the Board has for the well being of the organization and the consequences to the Board of its failures. At CIMMYT, the impact of Board failure over time to deal effectively with financial mismanagement or to hold management accountable is not felt nearly as acutely by the board as it is throughout the organization as it attempts to fulfil a vital mission with fewer resources and with a staff demoralized by uncertainty and the potential loss of employment. This unfair apportionment of consequences makes it all the more urgent for CIMMYT's board to act to improve its performance.

### **8.3 General Assessment of CIMMYT's Governance**

The Panel looked closely at the quality of board agendas, discussions and materials for the period since the last EPMR and leading up to the hiring of the new DG and the acknowledgment of the scale and seriousness of the financial problems facing CIMMYT. With that interval as a baseline, the Panel went on to examine the work of the board since that time (2001) to assess the extent to which changes to practice and structure provide a remedy to earlier problems and offer some assurance that history will not be repeated.

A portion of the governance part of the EPMR was timed to coincide with a meeting of CIMMYT's Board of Trustees, related meetings of Board committees, and a meeting of the Board of CIMMYT, AC, the Mexican corporation that holds title to CIMMYT's property and capital assets in the host country. Unfortunately, the Board meeting coincided with the general meeting of the CGIAR System, for which CIMMYT served as host. The demands of planning and organizing for this event competed with preparations for the Board meeting. The report attempts to distinguish between one-time problems with preparation or scheduling specific to the circumstances of this meeting and more serious or continuous challenges to the Board's operations.

With that in mind, the Panel has concluded that governance today is better at CIMMYT than in the recent past but still not good enough, and that an opportunity exists to rethink the role and value of the Board as CIMMYT moves forward.

In spite of the strengths that individual trustees bring to Board service and the effort of senior staff, the DG in particular, to engage and support the Board, the governance structure at CIMMYT is undernourished, not yet strong or well organized enough to work efficiently or consistently at the right levels. The Board is struggling to put Board processes in place, and is still negotiating with the staff for the level and quality of information it needs to provide good oversight and to participate effectively in policy and strategy development.

### **8.4 Defining the Role and Work of the Board more Effectively**

In 1997, the CGIAR published a series of booklets on governance of the Centers. The first, **Roles, Responsibilities, and Accountability of Center Boards of Trustees**, outlined the role of the Board and identified ten basic responsibilities common to effective boards. These

responsibilities have functioned as a guide for organizing board work and assessing Board performance since their publication. In practice, some of the responsibilities ascribed to the Board are more critical than others; a few are more aspirational than functional.

Every organization, as it changes or as the environment in which it does business changes, needs to have a Board that focuses its energy and expertise where it adds the greatest value. To do this requires that a Board be intentional about the nature of its work and organize itself to get it done. A clearer sense of what matters will drive the way agendas are developed, time is allocated, information is presented, the way committees are organized and charged, and the size and composition of the Board. It will also shape the relationship with the executive.

CIMMYT's Board like many Center Boards has assumed a generic role and structure for itself that does not serve the needs of the organization effectively.

CIMMYT faces pressing financial challenges; the arena in which it conducts its research is dynamic; it is reshaping itself to deploy new strategies; and it operates within an overarching system that lacks flexibility or nimbleness. The Board is structured and operates as though it was legally accountable for a well-endowed academic institution operating in the mid-20th century. Although the Board is getting smaller, it is still too large. It meets as a whole too infrequently for it to master information and use it in a sustained way to ask good questions, make good decisions or assess results. The committee structure, which might compensate for the infrequency of Board meetings, is not well designed and is not active between meetings in a way that would build knowledge and perspective, provide better oversight or create continuity for the Board.

Despite the complexity of the organization's operating environment and the resource challenges it faces, CIMMYT's Board lacks sufficient depth of expertise in financial analysis, in business management and in attracting new resources to provide an adequate level of informed oversight and support to management.

The Board is not a proxy for the staff; it cannot mimic in its composition and its work the structure and subject matter expertise of the staff. It has to organize itself and its work for the task of governance and create the structures and processes that will allow it to be effective.

In assessing where CIMMYT is and how governance can play a meaningful role in the coming years, the Panel **urges** a sharper focus at the Board level on CIMMYT as an enterprise. This may enable the Board to define its role more precisely, approach its composition more strategically and direct the Board's energy and capacity more effectively to critical responsibilities or functions, including:

- Linking strategy with results, enabling oversight and forecasting for planning, resource allocation and decision making;
- Establishing annual goals with the director general and a formal mechanism for reviewing the performance of the DG and the Board in meeting those goals;
- Understanding and using financial information to allocate resources effectively, assess results, manage risk, and anticipate problems and opportunities; and

- Accessing expertise when needed to support oversight and decision making in areas where incorporating it within the Board does not add value.

The CIMMYT Board must take the time to define its role and not just reproduce a more effective version of the traditional CGIAR Center Board. Once its role is clearer and more sharply defined it can deliberately shape the elements that will make it effective.

## 8.5 Board Size and Composition

The Board has been systematically reducing its size and during the period of the EPMR was working to get Board membership from 14 to 10, while retaining a good balance in terms of gender and geography (See Table 8.1 on Board composition from 1998-2005). The Panel endorses the move to a smaller Board and appreciates the extent to which the formula that is pervasive through the CGIAR System (requirements for host country, donor country, and CGIAR endorsed or appointed representation, and the inclusion of geographic, discipline, and gender diversity) makes this process difficult.

Nevertheless, the Panel believes a smaller Board requires a more strategic approach to populating it. During the course of the October 2004 Board meeting, the Board discussed the credentials of two potential candidates. Neither appeared to have been the result of a focused recruitment or cultivation effort and neither brought a set of skills or expertise that were not already plentifully available on the current Board or among the senior staff.

The Panel **urges** the Board to approach its composition strategically and determine the expertise, networks and skills that CIMMYT requires at the Board level to be an effective body, and recruit carefully against these criteria. In identifying new members, it needs to emphasize skills that relate to governance of a complex enterprise confronting challenging financial and strategic issues, and bring the level of expertise in finances, planning and management in balance with the current depth of Board experience in CIMMYT's program and research activities.

The establishment of a governance committee would help the Board build its capacity more strategically and intentionally, but the Board itself needs to rethink how it fulfils its role and critical responsibilities through the ability and expertise it gathers to itself through its members. The Board will always need to incorporate individuals with the background and experience to oversee and evaluate the quality of the research and programmatic activities of CIMMYT, and to help others on the Board to place that work in perspective, but the Board also needs to be diligent in recruiting people who bring equally deep experience of value in providing stewardship and oversight to other facets of CIMMYT's corporate life.

A high functioning and effective Board cannot be achieved solely through a strategic recruitment process but it is very hard to create such a Board without it. This particular task, along with a number of important issues relating to the quality of the Board's performance, requires more attention than it presently receives.

**Table 8.1 - Board Composition 1998 - 2005**

Name	Country	Speciality	Gender	98	99	00	01	02	03	04	05
Walter Falcona <sup>7</sup>	USA	Economist	Male	X	X	X	X				
Anthony K. Gregson <sup>8</sup>	Australia	Farmer/Agrobusiness	Male	X	X	X					
Atsushi Hirai	Japan	Geneticist	Male	X	X	X	X	X	X		
Johan Holmberg	Sweden	Diplomat	Male	X	X	X	X	X			
Xin Zhiyong	China	Molecular Biologist	Male	X	X	X	X				
Norah Olembo	Kenya	Biochemist	Female	X	X	X	X	X	X		
V.L. Chopra	India	Molecular Biologist	Male	X							
Bruce Hunter	Canada	Plant Breeder	Male	X							
William Dar	Philippines	Agronomist	Male	X	X						
Francisco Salamini	Germany	Molecular Biologist	Male	X							
A. Daaloul	Tunisia	Plant Breeder	Male	X							
Cary Fowler	Norway	Sociologist	Male	X	X	X	X				
Klaus Leisinger	Switzerland	Economist & Social Scientist	Male	Xc	X	X	X	X	X	X	
John Witcombe	U.K.	Plant Breeder	Male		X	X	X	X	X	X	X
Mangala Rai	India	Geneticist & Plant Breeder	Male		X	X	X	X	X	X	X
C. Felipe Jaramillo	Colombia	Economist	Male		X	X	X	X	X		
Uraivan Tan-Kim-Yong	Thailand	Sociologist	Female			X	X	X	X	X	X
Alexander F. McCallab	Canada	Economist	Male			X	X	X	X	X	X
Tini Colijn-Hooymans	Netherlands	Geneticist	Female				X	X	X	X	X
Robert Goodman	USA	Molecular Biologist	Male				X	X	X	X	X
Edwina Cornish	Australia	Molecular Biologist	Female					X	X	X	X
Lene Lange	Denmark	Molecular Biologist	Female					X	X	X	X
Hisao Azuma	Japan	Lawyer	Male						X	X	X
Romano Kiome	Kenya	Soil & Water Conservation expert	Male						X	X	X
Julio Berdegue	Mexico	Economist	Male							X	X
Ismail Cakmak	Turkey	Wheat Breeder/ Physiologist	Male								X

<sup>7</sup> Board Chair 1998 - 2001<sup>8</sup> Board Chair 2001 – 2005

*To help ensure that CIMMYT builds and sustains high functioning Boards, the Panel recommends the establishment of a governance committee with responsibility for a range of activities essential to Board effectiveness, including defining more clearly the role of the Board, developing a more strategic process for identifying and recruiting Board members, assessing Board performance on a formal basis, evaluating the performance of members before re-election, recommending improvements to Board practice, such as meeting design and preparation, information flow and communication, and developing an orientation and ongoing education program for members to enhance their performance.*

In both the non-profit and the corporate sectors, the governance committee has developed as the mechanism that enables the Board to assure that its own performance and the things necessary to that performance are safeguarded and managed. It goes beyond the conventional role of the nominating committee to look at the Board's work in a comprehensive way.

## **8.6 Board Leadership**

During the course of the October 2004 Board meeting, the Board member who had been identified as the next chair withdrew as a candidate for that position. This precipitated a very public and not very gratifying search for someone on the Board willing to take the assignment. This potential gap in leadership succession was finally resolved when a Board member expressed a willingness to do it in a year's time, and the tenure of the current chair was extending for an additional year.

While a governance committee cannot guarantee the elimination of this particular problem, it can bring a more thoughtful and farsighted perspective to leadership development, starting with the recruitment of candidates who bring skill, experience and willingness to this potential assignment.

Whatever the personal dynamics at work, the Board needs to build its own capacity to exert leadership at many points in its work and to recruit and cultivate leadership in a systematic fashion.

## **8.7 Governance Information**

While the Board is the legally accountable entity in an organization and considered to hold the ultimate responsibility for the efficiency and effectiveness with which an organization fulfils its mission and deploys its assets and resources, this formulation understates the difficulty a Board has in meeting its legal duties and obligations.

One of the complications that must be factored into assessing any Board's performance is the extent to which the staff has made the Board's work possible. Good governance involves the difficult achievement of balancing trust in the staff with a constructive scepticism that is always testing and looking for meaning while avoiding unproductive micromanagement.

Boards are heavily dependent on staff for the quality, timing and presentation of the information necessary for them to become knowledgeable, support good decision making and anticipate problems. Good governance depends in part on the staff's capacity to frame issues in a way that directs the Board's attention to the policy, strategy and accountability issues central to the Board's role. This dependency of the Board on the staff for the quality of its own work requires that Boards have a structure and processes in place that protect their independence and maintain their integrity. It also argues for a Board culture that overcomes the dysfunctional politeness that inhibits Board members from challenging each other or challenging staff for fear of being seen as aggressive or difficult.

In reviewing the Board materials, particularly the financial materials, distributed in conjunction with Board meetings during the period from 1998 through 2001, it is clear to the Panel that the Board materials made it difficult (although not impossible) to see both the nature of the financial management problems and the growth of these problems over time. Board members routinely received only statements of revenue and expenses, not the statement of financial position that highlights assets and liabilities, and would have brought the scale of receivables and the erosion in net assets more clearly into focus. The cover memos from financial staff glossed over the impact of these events to the operating budget and to cash reserves.

The same cannot be said of the audits, which while flawed, raised concerns with CIMMYT's accounting practices and controls that should have brought a stronger reaction from the Board. The same issues were flagged from year to year, and Board members did not hold management strongly accountable for improvements and changes to practice until CIMMYT's financial condition was dire. In November 2002, the Board asked management to adopt five measures to ensure fiscal management effective January 2003.

While the Panel notes improvements to the financial reporting, it is still not provided to the Board in a way that makes it easy to navigate, understand or analyze. One of the most telling moments at the October 2004 Board meeting was a simple graph that the DG put up as part of his report, tracking the status of the cash reserves over a seven year period. (This particular graph was a regular part of the DG's report beginning in 2002.) The graph made it easy for anyone with an interest in CIMMYT's financial health to grasp both the complete collapse of the reserves as well as the effort it would take to reverse the trend. Preceding Boards were seeing this information incrementally and in a context that muffled its meaning.

The Panel **urges** the staff to make a more systematic effort to present information, not just financial information, in formats that enable the Board to see results over time rather than incrementally and that also permit trends to be identified and discussed. Board members have recently proposed a set of indicators or "red flags" that the Board could review systematically from year to year. The CGIAR Secretariat has also developed a set of financial indicators that provide a strong snapshot of institutional health. These "dashboards" are a positive development that needs to be explored further with Board and staff.

The Panel would also like to comment briefly on the quality of the minutes recording the March 2004 Board meeting. They were by Board agreement much briefer and more concise than earlier meeting minutes. To anyone not in attendance at the March meeting, they

provided very little sense of the information covered at the meeting or the course of the discussion on key agenda items. The minutes are a corporate record; while there is no need for them to be excessively detailed, they do need to provide a clear record of corporate action that can be informative six months or six years later to someone not in the meeting.

## **8.8 Board Orientation and Learning**

Center Board members often have the experience of serving on other Center Boards or knowing Centers through their professional work. This familiarity has tended to reduce the urgency for orientation programs for new Board members. The CGIAR Secretariat offers an orientation to both the CGIAR System and to Board service but it is not uniformly attended by all new Center Board members, and even if attended, cannot compensate for an orientation process tailored to a specific Center and the specific requirements of that Center's Board.

It is likely that CIMMYT will increasingly add people who are relatively new to the Center and its work, and who need a systematic opportunity to learn about the organization and its operating environment. Even a new Board member familiar with CIMMYT needs an orientation to the work of the Board itself and an introduction to its financial and stewardship responsibilities. Orientation, in fact, is the way in which Board members are welcomed to CIMMYT and able to contribute quickly the expertise and perspective for which they were recruited. Although the culture of CIMMYT's Board is highly collegial, the experience of Board service would be enhanced and the quality of initial performance would be improved with a more thoughtful and comprehensive orientation process.

To provide the Board with ongoing opportunities to learn, it is the habit of the Board to meet at one of CIMMYT's field programs every third meeting as a way to broaden and deepen the Board's grasp of CIMMYT's work and to connect with staff and partners. It has also been the practice to use the meetings in Mexico as additional opportunities for the Board to gain a better understanding of the organization and to be available to staff. While these can add time to the meetings and expense to the cost of governance, the Panel views activities like this as beneficial to the ongoing need of Board members to be knowledgeable and remain connected to the mission and purpose of CIMMYT.

## **8.9 Board Operations and Processes**

The current Board has put in place some new safeguards for itself at the points where it is most dependent on the quality of the staff's work—a director general who understands the value and role of the Board, a clear mandate from Board to staff to reform the management infrastructure, and a new auditor. It has also worked to improve its own operations, making committee work functionally more transparent, becoming self-critical and more open to assessment, instituting improvements in the formatting of agenda items, and gradually reducing Board size in the interest of greater efficiency.

The Board has in place nascent processes that are important to maintaining Board capacity and function. While these take place consistently, the Panel notes that they are undertaken in an ad hoc or informal way that makes it difficult for them to be productive. This was

particularly true with the Board's self-audit for conflicts of interest, its self-assessment and the assessment of the chair, the last two done on the spot without much structure, preparation, or time for genuine reflection.

The Board must be an advocate for its own needs and insist within itself that Board meetings, communications and various self-auditing processes support effective governance. It must also insist that management do its part to make it possible for the Board to be diligent and careful. Achieving this is not without costs in terms of individual Board commitment and in staff time. Board capacity and the processes and structures that sustain it are badly undercapitalized.

*The Panel recommends that a dedicated staff person in the DG's office be identified to serve as the Board Secretary. This position should have sufficient status within the organization, clear responsibility and also adequate time to provide support and coordination for the Board.*

Currently, this assignment is scattered among two or three members of the staff who must provide the Board with support at the margins of their job descriptions. Even if not a full-time position, the Board, particularly the chair of the Board, needs to know that there is a single individual with responsibility for organizing Board meetings, coordinating the preparation of board-related information among staff, facilitating the work of committees between Board meetings as well as at the meetings themselves, and maintaining a calendar that assures that essential Board tasks and any work related to them take place on schedule. This individual can also help identify for the Board resources that will enable the Board to adopt or refine practices that maintain its effectiveness.

#### **8.10 Relationship with the DG**

The Panel observed that a good relationship existed between the Board and staff during the course of face-to-face meetings. It was not clear whether between Board meetings either the DG or individual Board members invited or provided feedback. The current infrequency of meetings makes some form of interim but regular communication important.

The DG has also encouraged interaction of the Board with senior staff during the course of Board meetings and did not seem to need to control staff presentations or the responses that staff shared during the course of Board meetings. The apparent ability of Board and staff to exchange information without too much centralized management of message may help avoid the concealment or massaging of data that may have been a contributing factor to lack of transparency leading up to the financial crisis.

A more problematic issue is the Board's evaluation of the DG. At the October 2004 Board meeting this was approached in the same ad hoc fashion as the Board's own self-assessment—without structure and limited opportunity for thoughtful reflection about goals and progress in meeting them. The on-the-spot assessment of the DG with a correspondingly casual discussion of compensation did a positive disservice to both the Board and the DG.

The Panel strongly **urges** that the Board chair and the DG develop a process for the DG's annual performance evaluation that enables the Board to make a fair and thoughtful assessment of the DG's performance against clearly agreed upon goals, that builds support within the Board for the DG's work, that strengthens the overall performance of the organization, and that provides the DG with a constructive place for self-evaluation.

To be effective and useful, the process as well as the criteria for the DG's performance evaluation needs to be developed by both the chair and the DG. The Panel is pleased that the DG is currently preparing a set of goals that will provide the first step in a more orderly and constructive process.

There are any number of ways to fashion a process that produces a good result for both the Board and the DG. It is essential though that the process be functional given the resources and time of those likely to be involved. Whether it involves the full Board or a subset of Board members, the full Board needs to engage in the process in an intentional way.

### **8.11 Board Oversight of Strategy and Results**

The Panel **suggests** that the Board organize its agenda to encompass both continuous items of Board work and strategic issues.

Having participated in a large-scale planning process, the Board's work does not yet link legibly to the plan. Issues of strategic importance were addressed at the October meeting but not in a way that referred with much urgency directly to the plan itself. This may be a matter of formatting as much as meeting design, and it may reflect the newness of the plan document itself, but as issues come to the Board, it should be clear where an issue fits into the strategic plan. In addition, the issue itself needs to be framed either by a Board committee or the staff in a way that helps the Board focus its attention and its decision making at the right level.

One potential tool for assessing the implementation of the strategic plan and for looking forward at the organization's growth and development is the MTP. It was surprising to see the MTP covering 2005-2007 treated in a perfunctory way by the Board. Although this document is viewed by Centers somewhat cynically as a system requirement, it also appears to be one of the few places where the Board can gain a perspective about the proposed momentum of the organization outside of the annual budgeting process. It would appear to be a particularly useful tool given the scope of the strategic plan and its implications.

The external audit is only one tool available to the Board as part of its oversight responsibilities. The CCERs are also important resources for the Board whether commissioned by it or by the staff. Although the last few years may not provide a good indicator of the Board's relationship to these reviews, it does not appear that the Board has always used them to assure improvements in the areas studied. The Panel views these as additional opportunities for the Board to provide oversight, and **suggests** that the committee structure or taskforces be given a larger role in helping the Board to extract greater value from them.

## **8.12 Resource Development**

The job of rebuilding CIMMYT's financial reserves has fallen almost entirely to the DG. It is clear that the unrestricted capital that constitutes the operating reserves is captured through a combination of good management and serendipitous currency exchange rates. The DG faces an almost vertical challenge in bringing the reserves to the right level—a challenge that may not be achievable in the current environment and with the management restructuring requiring substantial investment from unrestricted funding.

The Panel feels strongly that the Board needs to play a larger role in making the case to donors and others that the financial stability and sustainability of CIMMYT requires an accelerated investment in re-establishing its operating reserves.

Other areas of resource development involving the Board inevitably require substantial staff support and coordination to be successful. Beyond the urgency of the re-establishing the operating reserves, Board members may not be able to play an effective role in more broad based resource development. Nevertheless, Board members should be prepared to play a role when asked by the DG to facilitate a specific resource development activity.

## **8.13 Board Committees**

In an effort to build greater transparency within the Board and to increase the general level of knowledge and access to information among all Board members, Board members receive all committee material as part of their Board books and committee meetings are scheduled sequentially so that all Board members can attend committee meetings, whether members of the committee or not.

These practices have met their initial goals, but created unintended side effects. A Board committee or task force is a way to streamline Board work and to help the Board use its time and expertise efficiently. While this can lead to pockets of expertise that leave other Board members feeling in the dark or, in some cases, off the hook for certain kinds of difficult work, those problems can be avoided with good leadership and a clear sense of how the committee's work intersects with the full Board's responsibilities.

In CIMMYT's case, although individual Board members are assigned to various committees, when all Board members are at committee meetings, the committee chair appears to be the only person with a differentiated assignment. It is not clear how the committees as committees contribute anything to Board function. There are some exceptions but these appear to involve undertaking or completing tasks between meetings of the Board. As issues and recommendations that have effectively been decided emerge from the open committee meetings for formal Board discussion and action, the effect is to make the Board meeting itself feel like a mirror with a slight distortion. The time required to run committees sequentially combined with the cumbersome process of bringing committee recommendations forward to the Board when it is convened as a body deprive the Board of time that might more constructively be used for deeper, more thoughtful deliberations.

Having successfully straddled the knowledge and information gap that existed in the past, the Board should be able to re-think how it wishes to use committees. If committees remain a feature of the CIMMYT Board structure, the Board should consider refining their work as agents of the full Board; revise the schedule of the meetings held in conjunction with the Board itself to maximize the Board's time together as a Board; and encourage committees to work between Board meetings.

The committee structure and the function of committees needs to be re-examined and re-organized to give their work more meaning and create better value from their work for the Board. Board committees need to develop current terms of reference and annual plans of work.

#### **8.14 Finance and Audit Committees**

The finance committee and audit committee in particular need to have more regular and organized contact with the staff than is currently the case. Although financial information should be shared with the full Board on a quarterly basis, the chair of the finance committee and periodically the full committee should be reviewing the information with staff between meetings and spending time in advance of a Board meeting developing the agenda items related to financial issues and the documentation that the Board will need to be well informed and effective.

With respect to the composition of the finance and audit committees, there should not be significant overlap between the membership of the audit and finance committees if the audit committee is to meet one of its basic charges—to be independent. The audit committee also needs to have either as chair or as part of the membership someone with the financial analytical skills to provide rigor, independence and added value on behalf of the Board. (Chapter 9 on Management discusses the external audit function more fully.)

#### **8.15 Additional issues**

The IRRI-CIMMYT alliance represents another potential large scale change in the organizational life of CIMMYT. The nature of any alliance and its impact on the organization require that Board and staff frame and communicate issues with long-term implications for the mission of CIMMYT, its organizational culture, and financial sustainability in a way that enables the full Board to understand the implications of the changes and the requirements for success. The proposal to create either interlocking Boards or joint Board oversight of allied activities strikes the panel as an unwieldy and unworkable solution.

## 9 MANAGEMENT AND FINANCE

### 9.1 Legal Status of the Center

A number of important legal documents govern the status and operations of CIMMYT as an international research organization in Mexico. These include:

- 1943: a signed agreement between the Rockefeller Foundation and the Mexican Office of Special Studies for research and training collaboration which was a precursor for CIMMYT's establishment many years later.
- 1963: a signed agreement between Rockefeller and the Mexican Government establishing CIMMYT, AC, a Mexican corporation with limited privileges subject to the laws of the country.
- 1966: approval and issuance of CIMMYT's charter and by-laws
- 1988: a signed agreement between the International Bank for Reconstruction and Development and the United Nations Development Program establishing CIMMYT International
- 1991: CIMMYT, AC by-laws were revised changing its purpose inter alia into giving support to CIMMYT Int, as well as giving support to the Centers that are part of the CGIAR.
- 1989: a signed agreement between CIMMYT, AC and CIMMYT Int
- 2003: a new headquarters agreement between CIMMYT and Mexican Government, published in the Mexican Official Gazette on 25 March 2004.

#### 9.1.1 Legal Structure

CIMMYT, AC holds the title for CIMMYT's buildings and property as a Mexican organization under Article 2554 of the civil code for the Federal District and Territories. The collaborative agreement between CIMMYT Int and CIMMYT AC defines the use by CIMMYT Int of buildings and property held by CIMMYT AC. CIMMYT AC has its own Board which is required to hold a General Assembly at least once a year. The CIMMYT AC Board must include the Mexican Secretary of Agriculture and Livestock, the Director General of the National Agricultural Research Institute and Director General of CIMMYT Int. The CIMMYT AC Board is chaired by the CIMMYT Int Board Chair. Records of board meetings of CIMMYT AC must be maintained continuously as indicated in the Charter.

CIMMYT Int has its own Board which operates in accordance with the policies and guidelines set by the CGIAR.

##### 9.1.1.1 Implications

In spite of the complexity of the Center's legal and governance structure, CIMMYT enjoys a good reputation in Mexico and operates smoothly. However, there are difficulties relating to immunities, privileges and legal issues which are being handled on a case by case basis by Center management. The immunities and privileges which are not clearly defined in the new headquarters agreement need to be addressed urgently to ensure the smooth operations of the Center in the host country.

A complex legal structure like that of CIMMYT requires regular contacts by senior Center Management with the relevant government offices e.g. Ministry of Agriculture and

Livestock, Ministry of Foreign Affairs and Ministry of Finance. CIMMYT does not maintain regular high level contact with the appropriate ministries and government offices, which is essential for strengthening host country relations.

The Panel **suggests** that: a) Senior Center management, and frequently the Director General (DG), should pay regular visits to the high government offices; b) the Center should undertake an overall review of its headquarters agreement (especially the new agreement signed in 2003) to gain clearly defined immunities and privileges for the Center similar to most Centers in the CGIAR and other recognized international organizations, and to obtain full diplomatic status for the DG which is essential for carrying out his international responsibilities; c) the Center should develop an international agreement (to be signed by a number of countries (as stipulated and recognized by International Public Law) to strengthen CIMMYT as an international organization in Mexico and in other countries where CIMMYT has or is planning on establishing operations. The international agreement becomes the basis for a more comprehensive and relevant headquarters agreement.

## **9.2 Leadership and Management**

### **9.2.1 Leadership**

Prior to 2003, CIMMYT's direction was shaped more by the personalities and strengths of individual leaders than by the broader needs of the organization. Leadership even at the program level was not collaborative, leading to fragmentation of research and loss of direction at the Center.

Since July 2002, a new Director General has made significant progress asserting leadership for the Center by developing a new strategic plan and setting new directions for research and management. The Center is still at the initial phase of a major transformation and restructuring.

### **9.2.2 Executive Management and Organizational Structure**

CIMMYT is in the process of streamlining its senior management structure as it implements the new strategy and program structure and strengthens the control and monitoring mechanisms of Center operations.

From 1995-2003 (1995-2002 under the previous DG), senior management consisted of the Director General, Deputy Director General for Finance, and Administration, Executive Officer and five Program Directors. Program Directors had full autonomy to determine their program budgets, staffing and expenditure levels. No central management mechanism was in place to monitor plans, activities and resource utilization. This delegation of responsibility and authority to Program Directors led to overstaffing of programs, overspending, and a lack of research planning and control. Senior management lost control of operations, which contributed to a financial crisis starting in 1998. Resolving this crisis required management to implement major staff reduction programs, downsize operations and resort to expensive borrowing.

The present Director General (2002-present), faced with an extremely difficult management and financial situation, has given priority to strengthening the management structure and

building the appropriate leadership and management team to assist him in steering and managing the Center. He has hired a Director of Corporate Services, and established the post of DDG-R. Six directors of the newly reorganized research programs have joined the staff. The present structure is shown in Figure 9.1.

The new research programs are:

- P1: Genetic Resources (Global)
- P2: Impact Targeting and Assessment (Global)
- P3: Sustaining African Livelihoods
- P4: Rainfed Wheat Systems
- P5: Tropical Ecosystems
- P6: Intensive Agro-ecosystems

The Executive Management Team of the Center currently consists of the DG, DDG-Research, Director of Corporate Services and the Executive Officer/Project Officer. To ensure transparent and participatory decision making the Executive Management Team is supplemented by two committees; 1) Management Committee (Chaired by the DG) and the Program Committee (Chaired by the DDG-R).

The Panel commends the Board and the DG for the major restructuring of the Center management. The new management and research structure is now in place but still requires significant efforts to become fully operational including streamlining and revising support systems and processes of the Center.

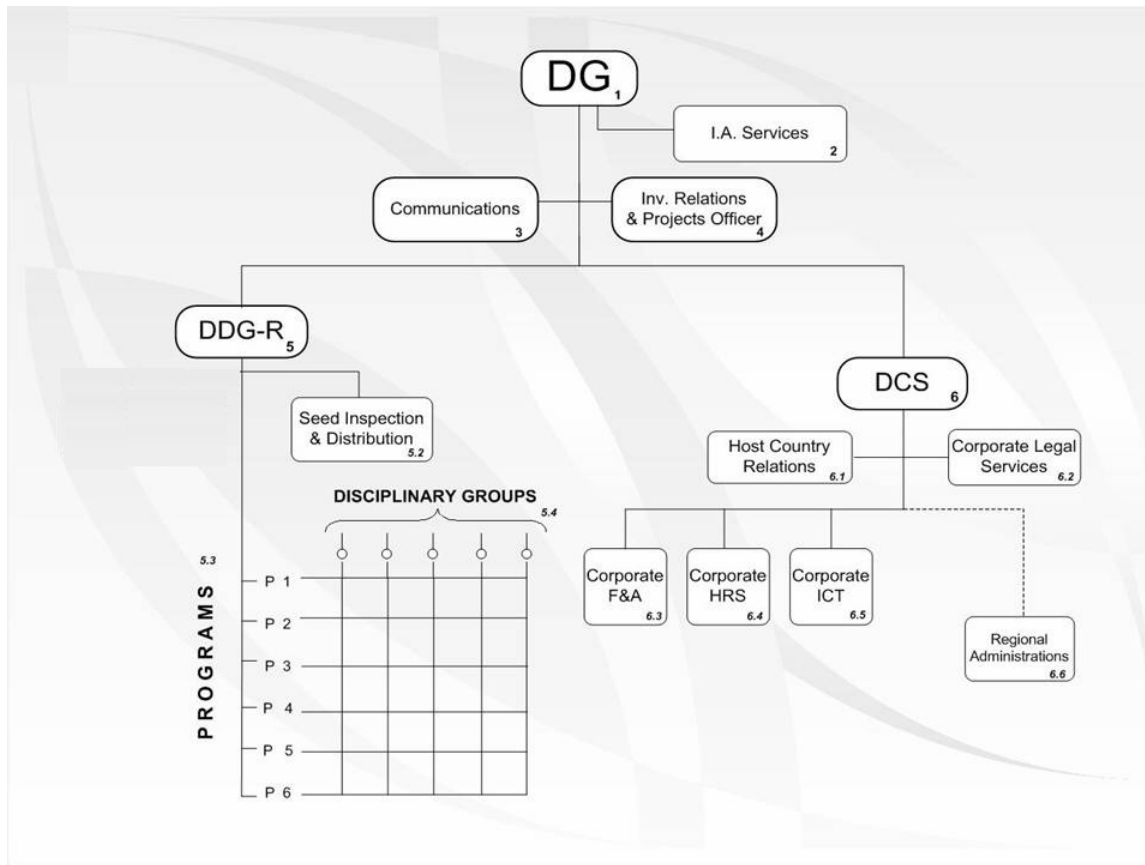
### **9.2.3 Program Management**

Research is now organized into six Programs (Figure 9.1) and five disciplinary groups (Maize Improvement; Wheat Improvement; Biotechnology; Social Sciences; Crop and Resource Management) to operate within a matrix management system.

The newly organized research programs and disciplinary groups will be led, managed and monitored by the DDG-R. Each program is led by a Program Director and each disciplinary group is coordinated by a group leader. Research will be managed within a matrix structure with the programs on the horizontal axis and disciplinary groups on the vertical axis. Most projects are within programs and some projects span some programs. Recruitment of program directors was completed in 2004 and all directors have been on board since February 2005. The recruitment process was transparent and comprehensive, consistent with international recruitment procedures and the processes followed by other CGIAR Centers.

The matrix management system is still being refined for implementation. It requires extensive consultation and training to be operational and to be understood by staff. The roles of the Program Director and Group Leaders are currently being defined. Most senior staff members have expressed concern regarding their lack of understanding of the matrix operation and its impact on research planning and execution.

Figure 9.1 - CIMMYT's Organizational Structure



To make the matrix operational, management should clearly define the roles and responsibilities of staff on both sides of the matrix, develop operating procedures including levels of authority and responsibility, develop a clear and transparent resource allocation process and put in place as a matter of urgency a financial management system to provide financial information and reports for proper control of Center operations.

Management should seriously consider developing a project management system for assessing, monitoring and tracking research progress and impact at the project/output levels. In July 2000 the Board and Management commissioned a CCER to review CIMMYT's MTP Project-Based Management System. To date, no progress has been made on the development of the project management system in accordance with the recommendations of the CCER.

All projects under a program within the matrix will be managed by the respective program director. No project leaders or coordinators will be appointed even on a rotational basis. The Panel **suggests** that management consider appointing a project leader or coordinator for each project to ensure close management and monitoring of outputs and to avoid returning to the old system where program directors enjoyed unlimited autonomy/control of their program resources and activities. To make the required impact, research projects should be of reasonable size and with the necessary critical mass of scientific staff and adequate resources.

The Panel **suggests** that Management: a) define clearly the roles of program directors including clear authority to manage their programs; b) provide management training to the key staff operating within the matrix; c) develop the required operating procedures and support systems for the matrix; d) develop financial and project management systems as a high priority for proper resource allocation and accountability.

## **9.2.4 Management of Challenge Programs**

### *9.2.4.1 Generation Challenge Program Purpose*

The Generation CP for Cultivating Plant Diversity for the Resource-Poor will use plant genetic resources to improve livelihoods and increase food security in developing countries. It will do so by enhancing the use of genetic resources in particular in breeding programs through innovative initiatives to generate, manage, and apply genomic information derived from comparative studies. It will enhance the public domain as the best means to ensure fair access and benefit sharing for resource-poor farmers.

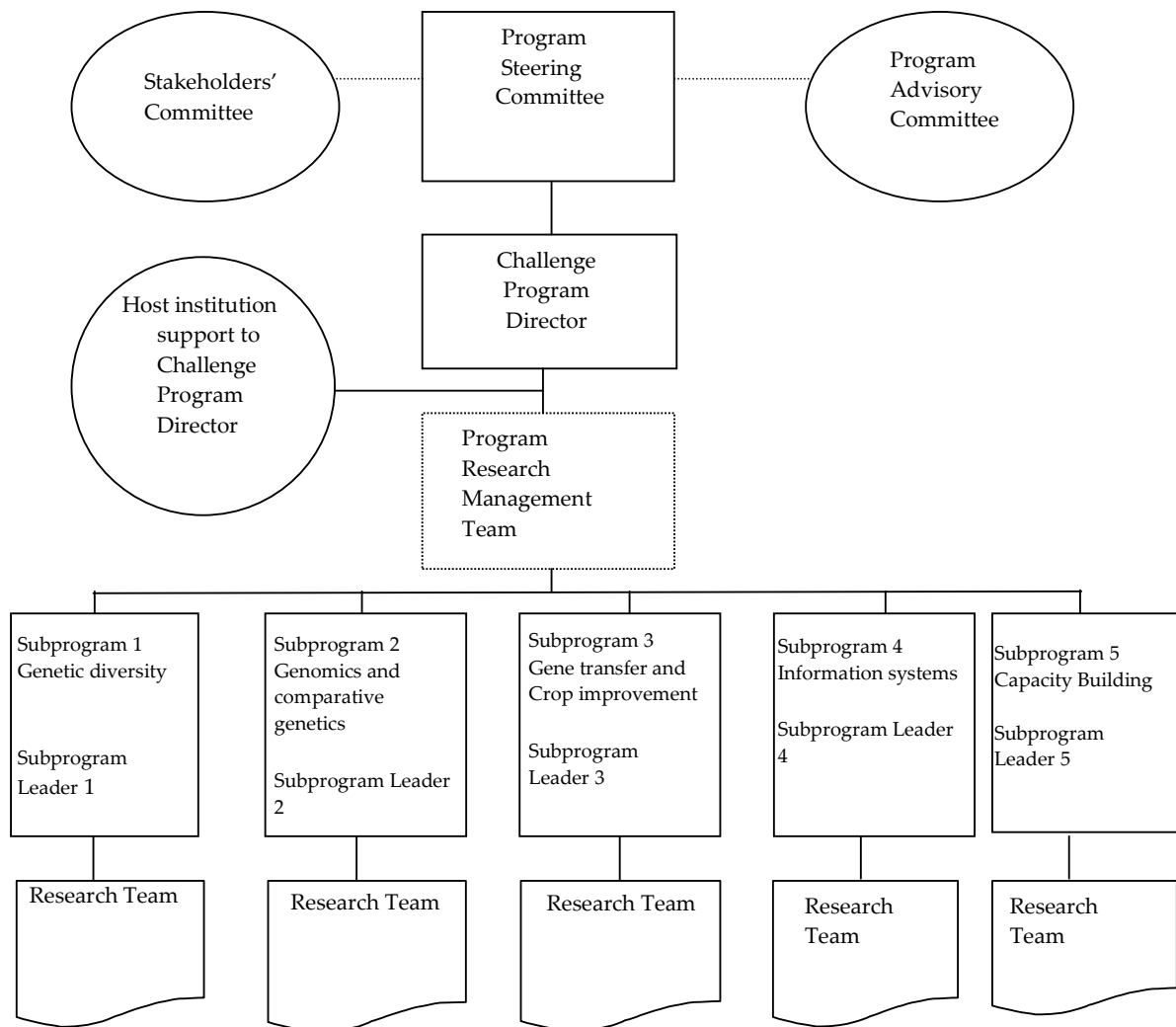
The activities of the Generation CP are organized around five Subprograms. Each Subprogram is managed by a Leader:

- Subprogram 1 – Genetic diversity of global genetic resources
- Subprogram 2 – Comparative genomics for gene discovery
- Subprogram 3 – Trait capture for crop improvement
- Subprogram 4 – Genetic resource, genomic and crop information systems
- Subprogram 5 – Capacity building

### *9.2.4.2 Challenge Program Governance*

The Generation CP was established as a Consortium of eight CGIAR centers (CIAT, CIMMYT, CIP, ICARDA, ICRISAT, IITA, IPGRI, and IRRI), and seven advanced research institutions. Each consortium member is represented on the Program Steering Committee (PSC), which also includes a representative from the Global Forum for Agricultural Research and an observer from the ExCo of the CGIAR. The PSC is advised on scientific matters by a Scientific Advisory Panel. The Scientific Advisory Panel is composed of internationally recognized scientists in the areas of genetic resources, molecular biology, functional genomics, crop improvement, bioinformatics, and capacity building for development. A Stakeholders Committee, consisting of outside observers from developed and developing countries, also contributes to the oversight of this CP. The CP activities are managed by a management team consisting of the CP Director and the five other subprogram leaders. CIMMYT hosts the Generation CP and has management and full fiduciary responsibility for the program. The management structure of the program is shown in Figure 9.2.

**Figure 9.2 - Generation Challenge Program Management Structure**



#### 9.2.4.3 Resources and Funding

The principle set by the CGIAR is that the CP should be an independent entity from the host Center and its funding should not compete with host Center research funding. The CP MTP budget should be separated from that of the Center. The host Center has administrative and fiduciary responsibility of the Program including management of its funds and their disbursement, accountability and financial reporting to various donors. The CP funding is projected to grow substantially by 2007 as per the 2005-2007 MTP of CIMMYT (Table 9.1).

Generation CP funding for the period 2004-2007 represents over 27% of total CIMMYT funding which should not be included in Center MTP 2005-2007 budget but should be reflected separately in the MTP.

The Panel **suggests** that the Board and Management of CIMMYT exercise close fiduciary oversight at an early stage to ensure that the Center does not carry additional liability and over commit its resources to the CP. At the CGIAR level the responsibilities of key participants including the host Center should be clearly defined.

**Table 9.1 - CIMMYT and Generation CP Funding 2004-2007 (US\$ million)**

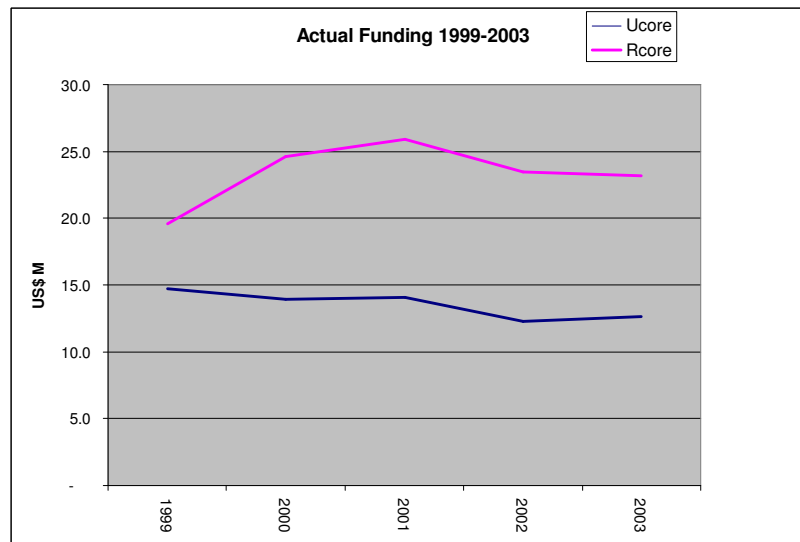
	2004	2005	2006	2007
CIMMYT Funding	36.0	35.0	33.0	33.0
Rice-Wheat Consortium	0.9	0.8	0.8	0.8
<b>Total CIMMYT</b>	<b>36.9</b>	<b>35.8</b>	<b>33.8</b>	<b>33.8</b>
Annual Growth (Decline)		(3%)	(6%)	(0%)
<b>Generation Challenge Program</b>	<b>8.4</b>	<b>13.3</b>	<b>15.0</b>	<b>16.5</b>
Annual Growth		59%	13%	10%

### 9.3 Resource Mobilization

Increasing and sustaining CIMMYT funding will mostly come from restricted project funding, which requires coordinated efforts in resource mobilization. Unrestricted funding at CIMMYT, which requires a different level of donor contact and coordination, continues to decline, making resource mobilization and management critical functions. CIMMYT has been very successful in the past in attracting adequate resources to finance its programs and operations, but less successful in managing its restricted funding. The pressure to increase project funding throughout the system has required that Centers restructure and strengthen their resource mobilization and grant management functions. They now put in place long-term resource mobilization strategies, developed in close consultation with research and management staff. CIMMYT is moving into that direction but its efforts need to be accelerated. In addition to a senior professional staff working directly with the DG to mobilize resources, the Center also needs to have transparent and formal systems for tracking and monitoring project proposals (and projects in the pipeline) accessible to program and management staff. The trends in CIMMYT's funding are shown in Figure 9.3.

The Panel **suggests** that the Center develops a long-term resource mobilization strategy for securing long term financing for Center activities and to strengthen the resource mobilization function. This is best achieved by appointing a dedicated professional staff to lead the resource mobilization function and to provide strong support to the Director General in his fund raising efforts.

Figure 9.3 – Trends in CIMMYT's funding 1999-2003



#### 9.4 Corporate Service Management

The Corporate Services Division at CIMMYT provides operational and logistical support to Center programs and units. The philosophy of Corporate Services should be to provide client-oriented and efficient services to donors, the Board of Trustees, management and staff. It should also assist the Board and Management in developing appropriate policies, procedures, and systems and in regular reviews of the effectiveness and efficiency of the Division's services in order to adapt and improve those services in a constantly changing environment.

To ensure that overheads are kept to a minimum and only essential positions are established, the Center should explore the outsourcing options of some services. Outsourcing depends on the market availability of the services and their effectiveness.

The vision of Corporate Services should focus on creating and managing a client-oriented culture dedicated to developing and delivering seamless, high quality and high value service.

Corporate Services should develop an operating strategy built on:

- **Operational Excellence:** smoothness, speed, quality, accuracy, consistency and reliability in execution and delivery.
- **Client Needs:** carefully targeted services to meet the broad range of internal and external client needs.
- **Cost Consciousness:** delivery of services at costs comparable or less than the market.
- **Superior Human Resources:** attract and maintain excellent human resources that share the vision, strategy and corporate values of CIMMYT.

- **Flexible Delivery Systems:** systems and processes responsive to the changing environments that rapidly adapt to the constantly changing needs.
- **Continual improvement:** Committed to continually improving on the effectiveness of services and service performance

The Corporate Services Strategy should be supported by a detailed three-year rolling operational plan with defined outputs and a timeline to effectiveness and results.

#### 9.4.1 Present Structure of Corporate Services

A new Director of Corporate Services joined the Center in April 2004. He has embarked on major changes in operations, systems and processes which are still in the preliminary phase of design. Corporate services require major restructuring to increase efficiency and reduce cost. A transformation in this area requires major changes in staff mix, quality and effectiveness. Substantial investments should be made in training existing staff to improve their skills.

The Director of Corporate Services manages the following functions/units: conferences and training; host country relations; experimental stations; administration; purchasing; finance; human resources; IT; and library. Some of the functions do not relate to Corporate Services and management should consider transferring or relocating them to other more appropriate areas at the Center. These include:

- **Host Country Relations:** This high level activity should be placed under the DG Office due to its sensitivity. The Director of Corporate Services can continue to assist in this area.
- **Experimental Farm:** This unit and its budget should be moved to research operations since this is a critical activity directly related to research.
- **Library:** This unit should be grouped with Corporate Publication (Communication and Publications function) which both are directly related to research also.

Based on interviews and Panel observations the performance of Corporate Services falls below standards in most areas. Policies and guidelines are non-existent (except in Human Resources-Personnel) or outdated. New policies and guidelines should be developed to support the operations of the new structure which includes the matrix management system. Operating standards should be raised to meet and exceed the expectations of Corporate Services' clients. The Panel **suggests** that Management considers adopting international operating standards to raise the performance of Corporate Services to private sector standards. ISO 9001:2000 certification should be considered which will lead to streamlining and codifying operating procedures to known and tested international standards. These ISO standards have been widely adopted and are now used in two CGIAR Centers. ISO quality management principles are presented in Appendix VIII.

Corporate services budget for 2004 amounted to approximately US\$ 12 million but it includes the Board, Director General Office, and various other research related activities. The Panel **suggests** that the budget for Corporate Services, and the Center as a whole, be adjusted to reflect the budget allocation by organizational unit of the Center rather than a single aggregate amount.

## 9.4.2 Human Resources Management

CGIAR has witnessed dramatic changes in the role of human resources over the past decade. Traditionally the human resources function was seen as primarily administrative. Human resource staff focused on administering benefits and other payroll and operational functions. Human resource function was not seen as playing a role in overall strategy. This is changing rapidly at the Center and System levels. A System-wide Human Resources Strategic Advisory Services (HR-SAS) was established in 2003 and is available to CGIAR Centers to assist them in developing strategic human resources functions. CIMMYT hosts the director for the CGIAR HR-SAS and should benefit greatly from this service. CIMMYT's Human resource function is becoming more strategic but requires the appropriate level of Human resource staff and Center commitment to move into this new direction. Strategic human resources approaches are especially important to the Center given that managing change (in center human resources, culture and operations) is critical to the future success of the new CIMMYT.

### 9.4.2.1 Role of Human Resources Unit

In consultation with clients, Human Resources should develop, implement and administer human resources systems, programs and activities designed to attract, motivate and retain efficient and effective human resources.

### 9.4.2.2 Changes in CIMMYT Human Resources levels

Due to the major restructuring of the Center, the new strategy development and severe financial difficulties, CIMMYT implemented two staff reduction programs over the period 2002- 2004. In addition, a large budget deficit in the Wheat Program in 2002 resulted in a specific reduction plan for that Program. Fine tuning of the staff mix and further rationalization of services are expected to continue in 2005. The Staff reduction programs are summarized below:

- **Voluntary Resignation Plan (April –October 2002):** Where Nationally Recruited Mexican staff members were given the option to voluntarily submit their resignations based on a pre-defined financial package. Program Directors decided on the voluntary resignations with final approval of the DG. Resignations of 36 NRS were accepted and a further 10 NRS opted for early retirement.
- **Staff Reduction Plan ( December 2002-November 2003):** Program Directors recommended staff for inclusion in the plan based on a pre-defined financial package and criteria for International Staff and local staff package was based on Mexican Labor law for NRS. 15 IRS and 56 NRS were included in the plan.
- **Wheat Program (April 2003):** Due to major budget overspending the Program Director was requested to provide a list of staff that should be separated. 6 IRS and 28 NRS (11 NRS in Mexico and 17 in regional offices) were separated from the Wheat Program.

Another reduction program was undertaken in November, December 2004 and January 2005 bringing staffing levels of the Center to 748 positions (Table 9.2).

**Table 9.2 - Staffing Levels as of February 2005**

	IRS	NRS	Total	Ratio NRS to IRS
Total	101 *	647	748	6.4
Females	15	117	132	7.8

\* The IRS positions include 14 adjunct and research associate positions.

The current number (as of February 2005) of female IRS is 15 or 15% of total IRS. The number of female NRS is 117 female or 18% of total NRS staff as of February 2005. Overall staffing changes are shown in Table 9.3. The Panel noted that none of the executive management hires is female. Management should make all possible efforts to improve the gender balance at the Center. The anticipated additions to professional and scientific positions at the Center provide management with an opportunity to look critically at its recruitment procedures, its accommodation of employees who bring a spouse and family to employment with CIMMYT, and the overall culture that must be free of policies or traditions that might disadvantage women's success in the organization.

The Panel commends management for taking the difficult steps of reducing staff and downsizing operations to strengthen the finances of the Center and reshape its research and operations. Given the severity of the reductions, management should put a high priority on addressing staff morale which is extremely low. More attention should be given to gender balance at the Center.

**Table 9.3 - Staff Changes 1999-2005 (Through February)**

Year	Reductions					Additions					Change Total
	IRS		NRS		*	IRS		NRS		**	
	M	F	M	F	Total	M	F	M	F	Total	
1999-2003	57	25	160	85	327	45	15	46	26	132	(195)
2004	19	6	10	1	36	14	6	55	13	88	52
2005 FTE	1	0	4	3	8	5	2	1	0	8	0
<b>Total</b>	77	31	174	89	371	64	23	102	39	228	(143)

\* IRS reduction of 108 staff include 42 adjunct and research associate staff

\*\* IRS Addition of 87 staff include 32 adjunct and research associate staff

The Panel **suggests** that CIMMYT management consider adjusting staffing levels at the regional sites consistent with the decentralized structure envisioned in the strategic plan. Currently (ref. Board document Oct 04) 80% of staff are located at headquarter in Mexico while 20% of staff are in regional locations.

#### 9.4.2.3 Management of Human Resources

The Human Resources unit has been led on an interim basis for approximately four years. With the changing of the human resource role and critical requirements for managing change at the Center, management should assess the human resource managerial position and appoint a permanent head of the unit.

#### 9.4.2.4 Personnel Policies

The Center has a set of personnel policies for each staff category. The Center hired a senior and experienced consultant to review these policies and other critical human resource activities. The revised Personnel Policies were submitted for Board approval but the IRS policy revisions have been discontinued. However, CIMMYT has proposed adoption of the One staff Policy to govern all staff at the Center and all staff policies revisions will be included in the One Staff Policy. The One Staff Policy contributes to an environment that enables staff to realize their full potential, develop a stronger commitment, to the Center, build teamwork and enhance their well-being.

The Panel **suggests** that Board and Management implement One Staff Policy which will create an environment that helps develop the full potential of all staff.

#### 9.4.2.5 Performance Assessment Systems

CIMMYT has an adequate performance management system in place. The Human Recourses consultant is developing a revised performance management system. The Panel **suggests** that management accelerate and give high priority to the implementation of the new performance management system to support the new organizational and matrix structure. It is essential that the system be implemented and training provided to all staff by mid 2005.

#### 9.4.2.6 Training, Career development and Promotion Policies

Training and career development are on the mind of every staff member of CIMMYT as has been indicated to the Panel. A systematic needs assessment of training and development should be conducted and corresponding programs developed with appropriate budgets allocations. This is essential to improve performance and increase the commitment of staff to the Center's goal and objectives.

Staff promotions were made on annual basis. Fifty nine IRS promotions were made from 1999 to 2004 (Table 9.4) representing 10% of IRS staff for the period and 236 promotions for NRS for the period 2000 to 2004 representing 6% of NRS staff for the period. In spite of the financial difficulties, the Center continued implementing its promotions policies for IRS and NRS. Some of the promotions did not involve salary increases but higher titles. Around five IRS promotions (or 8% of promotions) did not follow the Center promotion process. All NRS promotions followed the Center NRS promotions process. Several candidates who were not promoted petitioned for promotions, which indicates that the staff promotion system should be disseminated to staff in a more transparent way.

**Table 9.4 – Staff Promotions 1999-2004**

	1999	2000	2001	2002	2003	2004
IRS	14	14	3	8	10	10
NRS		44	99	40	17	36

No formal training was provided to staff during the review period. The Panel **urges** management to give priority to staff training and career development at this time of change at the Center.

#### 9.4.2.7 *Leadership and Management Training*

The new matrix management system requires scientists to manage staff, resources and relationships. These are critical skills required for all of CIMMYT's scientists. To make the matrix implementation successful, leadership and management training should be provided as a priority to senior scientific and managerial staff. The Panel **suggests** that management include this activity a high priority.

#### 9.4.2.8 *Recruitment Policies and Staff Orientation*

The Panel noted with satisfaction the recruitment policies of the Center and those under revision. However two issues need highlighting:

1. **Recruitment from within:** The present practice is that International Recruited Staff (IRS) vacancies are advertised internally first and if an internal applicant is found to be suitable for the position he/she is recruited without external advertisements or competition. If no internal applicants are found, the vacancies are advertised internationally. The Panel believes that this process limits the Center's ability to identify the most suitable candidates for positions and **suggests** that internal and external advertisement are made concurrently and that internal candidates are considered together with external candidates based on the same recruitment criteria and selection process.
2. **Orientation process for new staff:** New staff were interviewed by the Panel and asked for their assessment of the new staff orientation programs and materials. Based on the interviews and the Panel's own assessment, the present orientation program was considered cumbersome, outdated and fails to provide relevant information to new staff. The Panel **urges** management to revise the orientation program to provide more relevant information to new staff.

#### 9.4.2.9 *Salary Surveys*

The IRS salaries seem to be in line with the salaries of other CGIAR Centers based on a past study; however a new comprehensive salary survey for IRS is underway. CIMMYT will use the information to review relevant salary structure of its IRS.

A salary survey, for the NRS (Mexico) conducted by a consulting company with extensive experience with the country's compensation and human resource management, was undertaken in 2004 and is being considered by Board and Management. The Panel **urges** Management to review the staff salaries in light of the survey recommendations and budget availability of the Center.

#### 9.4.2.10 *Staff Survey*

The Panel conducted a staff survey in the form of a questionnaire consisting of 12 questions relating to CIMMYT culture, clarity of goals and mission, internal communication, working conditions, job satisfaction, staff empowerment, performance evaluation and staff morale. To ensure confidentiality, the Panel used an internet tool for responses and the summarization of results. The questionnaire was sent to 156 staff members (IRS and NRS –technician and above). 75 staff responded (48% of staff), 55 staff from headquarters and 20 from regional offices.

The findings indicated that staff morale is very low, decision making is not perceived to be participatory, staff performance assessment is not properly utilized. See Appendix IX for full survey results.

*The Panel recommends that management review the staff survey results in detail with special attention to staff morale, communication of policies, and clarity of goals, performance recognition, and staff evaluation, and take appropriate corrective action as a matter of urgency.*

#### **9.4.3 Financial Management**

The proper function of financial management is to ensure the financial viability and stability of the Center through proper resource allocation, accounting and financial reporting and provide client-oriented financial support services.

##### *9.4.3.1 Finance Unit and Financial Operations*

CIMMYT did not pay close attention to the financial management of the Center during the period under review. Financial management remains very weak and the Center has been unable to perform the basic functions of accounting, monitoring and reporting. The existing computerized accounting system does not provide the minimum required and relevant financial reporting to the Board, Management and programs. It is an outdated and inflexible system which was implemented by CIMMYT in the late 1980s. These deficiencies have led to a complete lack of financial control and have resulted in large and serious budget deficits. To compensate for these deficiencies, programs established their own accounting/recording systems which do not reconcile to the centralized accounting system of the Central Finance Unit. The numerous accounting systems at the Center have created a total breakdown in financial reporting, monitoring and control. Development of a computerized accounting and financial reporting systems should be given the highest priority.

Policies, guidelines and systems are also outdated and require major revisions to support the new matrix management structure.

The current resource allocation system is not consistent with the new program structure and should be reformed with utmost urgency. At the time (Nov 22-27) of the initial phase of the external review, Program Directors did not know the level of their program budgets or actual expenditures. The Board also was displeased with the financial information it received at its Oct 2004 meeting.

The necessary reforms to financial management require the allocation of adequate resources and competent and professional staff to assist the Director of Corporate Services to implement the major and critical changes within a short period of time. These changes are essential to support the new program/project structure and ensure the financial stability and viability of the Center.

*The Panel recommends that management give priority to reforming financial management at the Center including budget, staffing and related system with highest priority given to the development of the computerized financial management system which should provide real on-time financial information to users, and urgently develop (in consultation with program*

*staff) a transparent resource allocation process consistent with needs of the matrix management system.*

9.4.3.2 *Financial Stability of the Center*

Since 1998, CIMMYT has had a series of financial liquidity problems which have forced the Center to resort to expensive borrowing and downsizing of operations. There were major donor receivables write-offs in 2002 (US\$ 2.3million) and 2003 (US\$ 0.072 million) related to overbooking of grant income for period 1998 to 2001. This represented non-compliance with CGIAR Accounting Policies on grant recognition. In addition there were major over-expenditures (US\$ 2.1 million) by some programs in 2002 due to the lack of a proper resource allocation system, financial reporting, financial monitoring and control at the Center. These liquidity shortages and budgets deficits were financed by draw downs to the Center’s working capital with the knowledge and consent of the Board. The draw-down of the working capital (from 84 days in 1998 to 3 days in 2002) lead to a major liquidity crisis in 2003, which placed the Center in insolvency in 2003 (Table 9.5).

**Table 9.5 - The Working capital drawdown from 1998 to 2002**

	1998	1999	2000	2001	2002	2003
Working Capital (days)	84	48	49	43	3	35

The financial analysis and trends shown in Table 9.6 demonstrate the precariously weak financial position of the Center.

The financial crisis was mainly due to the failure of Board and Management to closely monitor the finances and financial position of the Center on regular basis. The external audit firm (Arthur Andersen) failed to emphasize forcefully the weak financial position of the Center, and CIMMYT’s internal auditor failed to recognize the serious financial problem early on and alert Board and Management to the looming financial crisis.

The Board should demand regular financial reports (monthly or quarterly) to include appropriate financial information for proper and close monitoring of the financial performance and health of the Center.

**Table 9.6 - CIMMYT Financial Position for 1999 to 2003 (million US\$)\***

(Includes ratio analysis and Financial Indicators)	1999	2000	2001	2002	2003
<b>Assets</b>					
<b>Current Assets</b>					
Cash and Cash Equivalents	8.0	3.9	2.9	1.1	7.4
Accounts Receivable	0.0	0.0	0.0	0.0	0.0
Donors	5.0	8.3	10.9	6.9	9.0
Employees	0.3	0.4	0.4	0.2	0.0
Others	1.0	0.9	1.0	0.8	1.1
Inventories	0.2	0.2	0.2	0.2	0.1
Prepaid Expenses	0.0	0.0	0.0	0.0	0.0
Other Current Assets					
<b>Total Current Assets</b>	<b>14.5</b>	<b>13.8</b>	<b>15.4</b>	<b>9.2</b>	<b>17.7</b>
<b>Fixed Assets</b>					
Property, plant and equipment	33.3	33.9	34.7	24.2	29.0
Less: accumulated depreciation	18.8	19.6	20.2	15.3	13.7
<b>Total Fixed Assets (net)</b>	<b>14.5</b>	<b>14.3</b>	<b>14.5</b>	<b>8.8</b>	<b>15.3</b>
Other Assets	0.0	0.0	0.0	0.1	0.0
<b>Total Assets</b>	<b>29.0</b>	<b>28.1</b>	<b>29.8</b>	<b>18.1</b>	<b>33.0</b>
<b>Liabilities and Net Assets</b>					
<b>Current Liabilities</b>					
Bank indebtedness				3.0	0.0
Accounts Payable:					
Donors	6.3	2.8	1.4	3.8	9.8
Employees	0.3	0.4	0.4	0.2	0.0
Others	0.5	1.7	4.2	0.7	3.7
In-trust Accounts	0.0	0.0	0.0	0.0	0.0
Accruals and Provisions	2.5	3.5	4.5	1.1	0.6
<b>Total Current Liabilities</b>	<b>9.6</b>	<b>8.4</b>	<b>10.4</b>	<b>8.8</b>	<b>14.0</b>
<b>Long-term liabilities</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Long-term loan	0.0	0.0	0.0	0.0	0.0
Others	0.5	0.6	0.7	0.7	0.6
<b>Total long-term liabilities</b>	<b>0.5</b>	<b>0.6</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>
<b>Total Liabilities</b>	<b>10.0</b>	<b>9.0</b>	<b>11.1</b>	<b>9.6</b>	<b>14.6</b>
<b>Net Assets</b>					
<b>Unrestricted</b>					
Unrestricted Net Assets excluding Fixed Assets	4.8	5.4	4.3	-0.3	3.1
Fixed Assets	14.1	13.7	14.5	8.8	15.3
<b>Unrestricted Net Assets</b>	<b>18.9</b>	<b>19.1</b>	<b>18.7</b>	<b>8.5</b>	<b>18.4</b>
<b>Restricted</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Total Net Assets</b>	<b>18.9</b>	<b>19.1</b>	<b>18.7</b>	<b>8.5</b>	<b>18.4</b>
<b>Total liabilities and net assets</b>	<b>29.0</b>	<b>28.1</b>	<b>29.8</b>	<b>18.1</b>	<b>33.0</b>
<b>Results of Operations / Outcome for the year ( Deficit)</b>	<b>(2.16)</b>	<b>0.203</b>	<b>(0.28)</b>	<b>(4.95)</b>	<b>0.72</b>
<b>Ratios/indicators</b>					
Current ratio	1.52	1.64	1.47	1.05	1.26
Working capital - in million US dollars	4.9	5.3	4.9	0.3	3.1
Working capital - in days of expenditures	50	51	45	3	39
Net Assets excluding Fixed Assets - in days of expenditures	43	43	37	(3)	30
Expenditures FS excluding depreciation costs	36.2	38.2	39.9	40.2	34.2

\* Source: CIMMYT Audited Financial Statements

The equity of the Center (net Assets less fixed assets) was negative (3 days) at the end of 2002 indicating insolvency. The Center has been well below the CGIAR System standards for the past five years as indicate in Table 9.7.

**Table 9.7 – CIMMYT Equity (1998-2003)**

	1998	1999	2000	2001	2002	2003
Equity: US\$ (M)	7.0	4.5	4.8	4.3	(0.3)	3.0
Days	80	43	43	37	(3)	30

The equity balance of US\$ 3.0 million in 2003 consisted of three elements: 1) US\$ 0.7 million from 2003 results of operation (excess of revenue over expenditures); 2) US\$ 0.1 million from write-off and sale of fixed assets 3) US\$ 1.9 million from revaluation of Center fixed assets. It is not clear to the Panel how the write-off and revaluation of fixed assets resulted in a net increase in equity of the Center of around US\$ 2.0 million. Management will be clarifying the equity (net assets) balance in 2004 accounts.

***The Panel recommends that Board and Management carefully review the adequacy of the level of net assets (equity) balance for 2004 which was increased in 2003 by approximately US\$ 2.0 million from fixed assets write-off and revaluation.***

CIMMYT Management has developed plans to improve the financial position of the Center and increase the working capital to 90 days of operation by 2007. The Panel commends CIMMYT's current management for taking appropriate action to reform the finances of the Center. However, fluctuations in unrestricted donor contributions are not helping the Center to reach the planned target set for 2007, and it may not be able to meet the target for 2004.

***The Panel recommends that the Board and Management develop a set of financial indicators for measuring the Center financial performance and health. The indicators should supplement those developed by the CGIAR System in close consultation with CGIAR Secretariat and Center Finance Directors.***

#### 9.4.3.3 Spending Patterns and Deficits

For the years 1999 to 2002 the Center grossly overspent its available resources and resorted to the full utilization of its working capital (in 2002) and to heavy borrowing. The revenues and expenditures are shown in Table 9.8.

The Center has been incurring large deficits for the period 1999-2002. However current Center Management achieved an increase in the unrestricted Center reserves of US\$ 3.1 million in 2003 which has strengthened the Center working capital and improved its equity, however the adequacy of the net assets balance for 2003 should be re-examined as indicated in the previous recommendation under 9.4.3.2.

**Table 9.8 – CIMMYT's Revenue and Expenditures in 1999-2003**

	1999		2000		2000		2002		2003	
	US\$	%	US\$	%	US\$	%	US\$	%	US\$	%
<b>Revenue</b>										
Unrestricted grants	14.5	41	13.9	35	14.1	34	12.3	34	12.6	33
Restricted projects	19.6	55	24.6	62	25.9	63	23.5	64	23.2	61
Center Income	1.3	4	1.3	3	1.0	2	0.7	2	2.0	5
	<b>35.4</b>		<b>39.8</b>		<b>41.0</b>		<b>36.5</b>		<b>37.8</b>	
<b>Expenditures</b>										
Personnel	19.1	51	20.2	51	20.2	49	21.5	52	18	49
Supplies and Services	15.3	41	15.9	40	17.9	43	16.7	41	15	40
Travel	1.8	5	2.1	5	1.8	4	1.6	4	1.2	3
Depreciation	1.4	4	1.4	4	1.4	3	1.3	3	2.9	8
	<b>37.6</b>		<b>39.6</b>		<b>41.3</b>		<b>41.1</b>		<b>37.1</b>	
<b>Results of Operations</b>										
Excess/ (Deficit)/Percent of Income	<b>(2.2)</b>	<b>-6</b>	<b>0.2</b>	<b>1</b>	<b>(0.3)</b>	<b>-1</b>	<b>(4.6)</b>	<b>-13</b>	<b>0.7</b>	<b>2</b>
<b>Indirect Cost Recovery</b>										
Overhead Recovery	<b>2.2</b>		<b>2.4</b>		<b>2.3</b>		<b>2.4</b>		<b>3.1</b>	
Restricted Expenditures	17.6	<b>13</b>	21.9	<b>11</b>	22.8	<b>10</b>	23.5	<b>10</b>	23.2	<b>13</b>

On the request of CIMMYT, a donor provided a short-term grant of US\$ 3.0 million over a two-year period (2004 and 2005) for implementing the strategy: hiring key scientific staff, financing the cost of staff changes, upgrading of scientific equipment and staff training. The Center is hiring 11 new long-term scientific staff at an estimated annual cost of US\$ 1.2 million. The short-term grant can cover new staff costs for around one year and the Center should raise after that annually (increase its budget) an equivalent amount (approximately US\$ 1.2 million) to finance these new positions on long-term. The Center should assess this high risk financing strategy of supporting long-term (recurring) commitments with short-term (one-time) financing and the impact of such strategy on the financial health of the Center.

The Panel **urges** Management to budget surpluses to build the Center working capital to the required level set by the CGIAR of 90-120 days of operations. Management should put in place stringent budget control mechanisms to avoid budget deficits. Management should examine the viability of financing long-term commitments with short-term funding.

#### 9.4.3.4 Indirect cost Recovery

Indirect cost recovery has been at an average of 11% annually for the period 1999 to 2003. Compared to the actual indirect cost of the Center of around 21%, recovery has been well

below the actual indirect cost of the Center (21%). The Center annual average indirect cost recovery (11%) is well below the actual indirect cost rate of the Center.

Most of the support units' expenditures are absorbed by unrestricted funding not charged back to users) including laboratory and experimental farm operations. CIMMYT should develop utilization rates that can be charged directly to users of the services.

***The Panel recommends that a full cost recovery/pricing system of services should be implemented to recover full costs from projects and users of services. This will reduce the pressure on unrestricted funding and make it available for other high priority activities at the Center including building the working capital to the required level.***

#### 9.4.3.5 Investment Policies and Cash Management

The Current investment policy of the Center appears to have been approved by the Board in 1989 (but not minuted). The investment policy covers two types of investments: 1) excess cash of operations and 2) training and capital development funds which can be a long-term investment opportunity.

The current investment policy allows Center management to invest funds in different financial instruments including the equity market which may expose the Center to unnecessary risk and which requires professional expertise to assess and monitor effectively. The Panel concurs with the Center in not having a policy dealing with currency speculation and diversification which are highly risky and require special professional expertise.

The Panel **suggests** that the Board and Management review and update the Center investment policy and limit fund investment to non-risk instruments such as fixed deposit accounts and similar financial instruments. Currency speculation should continue to be outside the investment mandate of the Center.

#### 9.4.3.6 Medium-Term Planning and Financial Projections

The Medium-Term Plan of the Center should be developed in consultation with programs and management staff and follow the guidelines issued by the Science Council and CGIAR Secretariats. The MTP should be a planning and working document that should reflect the actual work of the Center.

The Panel reviewed the financial aspect of the MTP 2005 – 2007 and finds the document adequate however; it does not include all financial tables required by the guidelines. It is recommended that the development of future MTPs be consistent with the guidelines issued by the CGIAR and Science Council Secretariats. The Panel **suggests** that the MTP document be used as a planning document for a) research project implementation and monitoring and b) resource mobilization and fund raising. It should not be developed to satisfy the CGIAR reporting requirements only. The financial projections indicated in MTP 2005-2007 are shown in Table 9.9.

The current 2004 (operational) budget for the Center is US\$ 44.7 million (Including the Generation CP and RWC) or US\$ 0.5 million below the MTP projections for 2004. In the absence of a budget system it is not possible for the Panel to make an assessment of the

impact of the new additional positions on the future budget of the Center. Management should keep the proportion of fixed cost (salaries and benefits) within the 50% limit of the operational budget of the Center consistent with CGIAR practice.

**Table 9.9 – Financial Projections 2004-2007 (US\$ million)\***

	2004	2005	2006	2007
<b>A. Programs</b>				
1. Genetic Resources	6.03	6.15	5.83	5.82
2. Impacts Targeting and Assessment	2.73	1.86	1.56	1.55
3. Sustaining African Livelihoods	8.20	7.94	7.86	7.84
2. Rainfed Wheat Systems	6.08	6.06	5.63	5.61
5. Tropical Ecosystems	5.13	5.11	4.77	4.65
4. Intensive Agro-ecosystems	7.75	7.76	7.38	7.36
Total	35.92	34.88	33.03	32.83
<b>B. Challenge and Other Programs</b>				
Generations Challenge Program	8.39	13.30	15.00	16.50
Rice Wheat Consortium	0.88	0.83	0.83	0.83
Total	9.27	14.13	15.83	17.33
<b>Grand total fund projections</b>	<b>45.19</b>	<b>49.01</b>	<b>48.86</b>	<b>50.16</b>

\* Loaded figures with management and support costs

Expenditures for 2003 were at the level of US\$ 37.1 million net of overhead recovery and US\$ 40.2 million before overhead recovery. The Growth of 2004 current operating budget over 2003 actual expenditures is around US\$ 5.0 million or 12% mostly related to the Generation CP which should not be integrated in Center budget.

The growth in funding projections is attributable to the Generation CP which is projected to increase 96% by 2007. Center program funding is projected to decline by around US\$ 3.0 million by 2007.

The Panel believes that the Center research program should continue to grow to preserve the purchasing power of research budgets and to ensure financing of CIMMYT mandate as defined in the new strategic plan.

#### 9.4.3.7 *Planning and Budgeting Process*

As indicated earlier in the report, the planning and resource allocation process at the Center needs substantial restructuring. The current budget process handles the control aspect of the budget only but not in an effective and efficient manner. Management should consider establishing a separate planning and budget unit headed by a qualified and experienced manager reporting to the Director for Corporate Services that reflects the size and complexity of CIMMYT's operations and finances. The planning and budget process is an essential function for allocating resources in a formal manner consistent with Center strategy and priorities. The main functions of the planning and budget unit are to assist in the formulation, development and management of the budget, including the establishment of

databases, systems, procedures and guidelines, assist in the development of MTPs, financing plans and project proposals to donors, and provide assistance in financial planning and budget services to the Board, Management, programs and units to reduce transaction costs.

The Panel **suggests** the establishment of Planning and Budget Unit within Corporate Services to lead the planning, budget and control functions. The unit should be headed by a qualified and experienced professional.

#### *9.4.3.8 Audit of Center Operations*

Center operations are subjected to external and internal audit mostly at headquarters. Few audits have been conducted for regional sites. Since the Center is decentralizing its operations more attention should be given to regional site audits.

#### *9.4.3.9 External Audit*

**Arthur Andersen:** Up to 2001 Arthur Andersen was the appointed external auditor of the Center. From a review of the financial statements for the years 1999 to 2001 and related management letters it can be surmised that the audit firm did not fully implement the CGIAR Accounting Guidelines (which are in conformity with US Generally Accepted Accounting Principles as of 2003). There were numerous exceptions relating, among others, to booking restricted grant income and corresponding receivables, and the treatment of fixed assets. Their Management Letters did not emphasize enough to management and Board the seriousness of the accounting exceptions and their impact on the overall financial health of the Center. In spite of these serious accounting flaws, the external auditor signed the audit reports for the period 1998-2001 and gave clean audit opinions. No exceptions were indicated in the audit opinions despite the gross overstatement of income by the Center from 1998 to 2001 which resulted in major write-offs in 2002 (stated earlier) and caused a major financial and liquidity crisis for the Center in 2003.

**Deloitte:** The firm was selected to replace Andersen for the 2002 audit. From audit reports of 2002 and 2003, Deloitte appears to have done a fair job and their management letters highlighted substantial issues and recommended corrective action for the overstated receivables and valuations/booking of Center fixed assets. The Panel conducted a teleconference with Deloitte Audit Partner who seemed to be familiar with all the current accounting issues of the Center. However, Board and Management should exercise a more proactive role and a stronger hands-on approach in audit planning, audit work and evaluation of the external auditors. Board and Management's active and regular involvement with the external and internal auditors' plans and work programs are critical for ensuring the strong financial health of the Center.

***The Panel recommends that Board and Management:*** a) *make substantial efforts and allocate adequate time for the careful review of the external audit (headquarters and regional sites) management letters and audited financial statements with the notes.* b) *Carefully review the annual audit plans and scope of external audit for headquarters and regional sites;* c) *formally assess annually the performance of external auditors of the Center and decide on annual appointment.*

#### 9.4.3.10 Internal Audit

The Center has a senior internal auditor and also shares in the CGIAR Internal Audit Unit. The CGIAR Internal Audit Unit is attempting to professionalize internal audit at CGIAR Centers and increase awareness of the importance of internal audit at Board and Management levels. Eleven out of the 15 CGIAR Centers (including CIMMYT) participate in the CGIAR Internal Audit Unit.

The Panel reviewed the senior internal auditor's work for the period 1999-2004 and is of the opinion that the work focused on routine issues and did not address strategic financial and operational matters. The Internal Audit findings have been minor and did not add value to the Center's financial control systems.

The internal auditor also failed to alert management on the exceptions made in the accounting treatments of revenue and booking of fixed assets which greatly weakened the financial position of the Center.

Internal audit should undertake more audits of the regional sites of the Center.

***The Panel recommends that Board and Management review the scope of internal audit work and the capabilities of the senior internal auditor and make the required changes to greatly strengthen this important function.***

## 9.5 Information Technology

Information technology (IT) management is the cornerstone for knowledge management in any organization and more so for a knowledge-based organization like CIMMYT. At CIMMYT, information management relates both to scientific aspects of Center research and to the management and upkeep of the Center's internal and external communication systems.

The Panel supports CIMMYT's recent transfer of the IT unit from Genetic Resources to Corporate Services to ensure more efficient operations and standardization of hardware purchases.

IT is organized in six functions staffed as follows:

- Unit Management – 2 staff
- Systems Development including the function of Help Desk – 12 staff
- Software Development- 7 staff
- Telecommunication – 3 staff
- Library – 7 staff

The 2004 budget of the Unit is US\$ 1.5 million (Salaries and benefit US\$ 0.7 million; General Operating Cost US\$ 0.4 million; and Capital US\$ 0.4 million). The budget is totally supported by unrestricted core funding and the services are not charged back to users.

IT also provides support to around 363 computers of which 100 are laptops. Around 55% of desktops may need to be replaced. Most of the desktops are being upgraded to Windows

2000 including the necessary RAM upgrade for the implementation of the CGIAR-wide Active Directory.

From interviews with users and the Panel own observations, the IT unit is providing adequate support for communication (Internet, e-mail etc.) and hardware. IT is not involved in the database management for research but provides some programming support.

CIMMYT IT Unit interacts with the CGIAR Chief Information Officer but the interaction can be greatly improved to benefit more for services for which CIMMYT provides annual budget contributions.

There is no strategy or long-term plan for the operations of IT at the Center defining its future role in CIMMYT decentralized structure.

A CCER was conducted in February 1999 for IT at CIMMYT with a primary goal to provide a foundation for the development of a unified, seamless information environment that incorporates proven, state of the art technology. The CCER report addressed technical and management issues and made a number of recommendations. Management has not implemented the recommendation fully yet. The Panel **suggests** that Management review in the CCER report in detail for the implementation of relevant recommendations.

The Panel **suggests** that Management should: a) rationalize the staffing and budget of the Unit which seem to be high compared to other CGIAR Centers; b) develop long-term strategy and plans for the Unit consistent with the decentralized approach of CIMMYT; c) Consider placing the Library with Corporate Communication; d) Develop long-term hardware replacement plan for annual implementation; e) develop a cost recovery system for the IT unit.

## **9.6 Library**

The CIMMYT library contains around 28,000 publications and 120 journals which can be accessed on line. The space allocated to the Library is adequate and the Library is well kept. Currently the Library has 7 staff and the head has been appointed on an interim basis since 2001. The Library serves its clients well as per interviews with some users. The Library interacts with other librarians in the CGIAR System.

Currently the library reports to the Head of IT of the Center. As indicated earlier Management should consider relocating the Library to corporate communication and publication unit. Management may consider the appointment of a head librarian on fixed term rather than interim basis.

## **9.7 Administration and Operations**

The Units under administration and operations include travel, visitors, transport, maintenance, security and other support services. These services seem to be running well and serving the needs of the Center however, the Center should review the administrative and operations services critically for further staff rationalization to reduce cost and increase

efficiency. An example would be the review of the number of vehicles at the Center (approximately 300 presently) to rationalize the number of vehicles by assessing their utilization and running/maintenance costs.

#### **9.7.1 Purchasing Unit**

The purchasing function at the Center is weak and not responsive to client needs. From discussion with users it seems that local and overseas purchases arrive late and numerous follow ups are required for delivery. Also staff indicated that most materials procured through Purchasing are overpriced and of inferior quality.

The Panel **suggests** that a review is undertaken of materials management (including stores and receiving), staffing, practices and systems to increase the efficiency of the Unit and reduce cost.

#### **9.7.2 Self-Sustaining Services**

These include food services, guesthouses, and staff housing. We understand that the budget subsidy for these operations is approximately US\$ 0.2 million annually from the unrestricted core budget of the Center. The Panel did not have time to undertake a detailed study of the management and operations of these services and **suggests** that Management examine the high staffing and operating cost, implement better cost controls and consider outsourcing the food services. The Panel believes there is scope for substantial rationalization of these support services.

#### **9.7.3 Security and Safety**

CIMMYT has its own in-house security unit consisting of 22 security staff including the head of security. Security at the Center seems to be adequate with no major security breaches/incidents reported to the Panel. Security cost at the Center seems to be high due to the long tenure of most of the security personnel at the Center.

To revitalize security at HQ and strengthen it at the regional sites the Panel **suggests** that: a) management develop an overall plan of safety and security for all CIMMYT sites including regions where CIMMYT operates; b) Management explore outsourcing security to a professional security firm at headquarters and retaining an in-house professional security head to monitor and assess the performance of the contracted security firm. Similar process should be considered for regional sites.

#### **9.7.4 Experimental Farm**

Due to time constraints the Panel was not able to visit other non-headquarters experimental stations. The experimental station at headquarters (El Batan) is well run and provides the required services to programs as per interviews with research staff. A review of the equipment inventory list and field visit indicate that most of the equipment even though old is well maintained, however a number of field and research equipment require replacement (due to high maintenance cost) after the implementation of the decentralization structure and shifting of research operations to other regions of the World ( Asia and Africa).

The El Batan Experimental farms manager reports to the Director of Corporate Services. In similar organizations within and outside the CGIAR the experimental farm falls under

research operations. The Panel therefore **suggests** that the El Batan experimental farm is placed under research.

The Panel was surprised to learn that the budget of the experimental farm (at El Batan) is fully supported by unrestricted core funding and services are not charged back to users and projects. This practice applies to all support services at the Center. By not recovering the cost of services from users and projects, support unit costs are placing heavy demands on the declining unrestricted core budget of the Center.

The Panel **suggests** that: a) in light of the decentralization of the Center operations to other regions, Management should critically examine the level of utilization and activities (land area to be planted) of the experimental farm at headquarters and sites in Mexico; b) Management develop a charge-back /billing system to users of the farm services regardless of source of funding. This applies also to all support services at the Center; c) the experimental farm be transferred from Corporate Services to research.

#### **9.7.5 Infrastructure and Space Allocation**

Maintenance and upkeep of the Center infrastructure and buildings were neglected in the past due to budget shortfalls, but the recent priority given to infrastructure maintenance has resulted in most of the buildings now being in good condition. The Panel was not provided with annual maintenance plans and budgets for maintaining the buildings to international standards. The Panel **suggests** that a long-term infrastructure maintenance plan is developed taking into consideration the decentralization of staff and operations to other regions.

Space availability seems to be abundant after the implementation of the staff reduction plans at the Center. To rationalize the cost and utilization of space, Management may need to consider closing or leasing of some buildings and laboratories consistent with staff size and the decentralization of operations to other regions.

#### **9.8 Risk Management**

To ensure that CGIAR Centers funding is utilized in a low risk operating environment and that Centers adopt policies on risk management, some donors are requiring Centers to assess potential risk in their operations to include research.

The Center's risk management process should be designed to systematically identify and manage high and significant risks and opportunities relating to the achievement of the Center's business objectives.

In October 2003 CIMMYT initiated the risk management approach based on a framework developed by the CGIAR Internal Audit Unit in collaboration with the Center Internal Audit Unit. An assessment of risk areas was developed, mostly focusing on operational aspects and little on research. The risk assessment requires the input of CIMMYT Board and Management and should not be left entirely to the Center Internal Auditor. The initial work that has been done by internal audit requires an in-depth review by CIMMYT management to become relevant to the Center.

The Risk Management approach should concentrate on high risk areas in the initial phase with responsibilities that may be assigned as follows:

- The Center's Board of Trustees has overall responsibility for ensuring an appropriate risk management process is in place.
- The Center's director general is responsible for the Center-wide implementation of a risk management system, creating an environment in the Center whereby high risks are appropriately identified, assessed and acted upon in accordance with the Center's policies.
- The Center's staff are responsible for ensuring that high risks are considered for all business processes under their responsibility, and for identifying appropriate risk mitigation strategies after due consideration of costs and benefits.

A senior staff member should be designated as a focal point (Senior Risk Coordinator) for integrating the results of risk management activities throughout the Center and to support Management and the Board in the preparation of Center-wide assessments and reporting.

Internal audit and the senior risk coordinator are responsible for reviewing the design and effectiveness of the risk management system and internal controls on an ongoing basis, and reporting the results of its reviews to the director general and the Board of trustees, through the audit committee.

The CGIAR Internal Audit Unit should periodically assess the risk management systems and processes at the Center and report compliance to the DG and Board.

The Panel commends management for initiating the risk management approach and **suggests** that priority should be given initially to high risk areas of the Center.

## **9.9 Intellectual Property Management**

CIMMYT's deepening involvement in public-private collaboration during the 1990s and its increasingly sophisticated approaches to plant breeding and biotechnology required Board and Management to formulate a realistic intellectual property policy. In a series of statements which were revised in May 2000, CIMMYT acknowledged that the evolving landscape of international agricultural research imposes on public sector institutions new responsibilities of vigilance and stewardship over valuable resources in their possession. It appears that CIMMYT has abided and respects international agreements, national laws of the countries where it works, and contractual and other rights of persons and entities who have supplied their propriety research material to CIMMYT. (All contracts now include explicit intellectual property statements.) However, CIMMYT must also attend to its own inventions, discoveries, scientific and artistic works and other intangible assets.

With regards to these assets, CIMMYT's current policy explicitly reserves the right for the Center, on a case-by-case basis, to seek statutory protection such as patents, plant variety rights, copyrights, and trademarks for the following purposes:

1. to support public and private partnerships which pursue mission-based research or which develop and apply research results;

2. to assure ready access by others to research products developed or funded by CIMMYT;
3. to avoid possible restrictions arising from “blocking” patents and to ensure CIMMYT’s ability pursue its research without undue hindrance;
4. to facilitate transfer of technology, research products and other benefits to the resource poor including, where appropriate, through commercialization of utilization of products; and /or
5. to facilitate the negotiation and conclusion of agreements for access to proprietary technologies of use to CIMMYT’s research and in furtherance of its mission.

CIMMYT does not protect its intellectual property for the purpose of generating revenues. However in the past, CIMMYT entered into large contracts with a private firm and foundation that have been discontinued by the current Director General and Board (as indicated by the DG) because they were not favourable to CIMMYT and were not consistent with IPR Policies of the Center.

The Panel commends CIMMYT’s Board and Management on the handling and management of Center Intellectual Property and its continuing efforts to revise these policies to serve the future needs of the Center and its clients.

#### **9.10 Center Commissioned External Reviews**

No CCERs were conducted for Corporate Services Unit and activities during the period 1999-2004 except for IT which was conducted in 1999. This made the review task of the Panel difficult and time consuming. Because of the lack of earlier reviews and in order for the Panel to make a reasonable assessment of the effectiveness of Corporate Services, these areas and activities were reviewed in depth.

The Panel **suggests** that a number CCERs should be conducted for the major areas of Corporate Services over the next five years. A plan should be developed and reviewed by the Board for implementation. This is critical at this stage of major changes in the structure, operations and processes of Corporate Services.

#### **9.11 Interim External Review of Major Change and Restructuring Plans**

The 5<sup>th</sup> External Review coincided with a major restructuring and transformation of the Center and its support units. The new strategy and structure are being implemented and all support services are gearing their operations to support the new structure including the matrix management system. The Panel could not reasonably judge how efficient these new systems, approaches and new structure will operate. The Panel was unable to objectively assess the impact of these changes on the future progress of the Center. An interim review in mid 2007 is recommended. (For recommendation see Chapter 2)



## 10 CONCLUDING COMMENTS

### 10.1 CIMMYT Today

As noted at the outset, CIMMYT has undergone a period of profound change involving all aspects of the Center's operations. It suffered a deep financial crisis, the depths of which coincided with the appointment of a new DG in 2002. While CIMMYT's finances have now been stabilized, it is still building its financial reserves in a competitive funding environment, and it is likely to be a number of years before its financial health meets the minimum standards required of an international Center. It has gone through a wide ranging and comprehensive strategic planning process which resulted in a new mission, organizational structure, and strategic plan for the Center. The new strategic plan provides a strong vision for CIMMYT in the future and commits the Center to a more impact-orientated and decentralized program based on interdisciplinary research and the use of partnerships with a wide range of other organizations including other CGIAR Centers, ARIs, NAROs, and NGOs, to leverage capacity with and to help accelerate technology uptake and impact.

The new program structure for the Center creates a matrix of 2 Global Programs (Genetic Resources and Impacts Targeting and Assessment), 4 Ecoregional Programs (Sustaining African Livelihoods, Rainfed Wheat Systems, Tropical Ecosystems, and Intensive Agro-Ecosystems), and 5 Disciplinary Groups (Maize Improvement, Wheat Improvement, Biotechnology, Social Sciences, Crops and Resource Management). Over the last year, CIMMYT has moved strongly to implement this new structure. CIMMYT has also radically altered its staff profile through a combination of staff downsizing and a staff renewal program aimed at better aligning its staff competencies with its new strategy and program structure. In addition, it has put a new, experienced management team in place to support the DG.

However, while much has been achieved in restructuring and revitalizing CIMMYT over the last 18 months, it is still very much a Center in transition, and much remains to be done. The EPMR Panel concluded that improvements in Board processes and governance as well as in a number of management processes, including the implementation of modern and effective systems for financial and project management, full cost recovery/pricing for support services, and the internal and external audit functions, are a high priority for CIMMYT as it moves forward. Other key areas that will require further attention in the short term are the development of specific goals for its new strategy as well as a business strategic plan. CIMMYT also needs to develop detailed operational plans to match with those specific goals and to ensure the new matrix structure functions effectively from the outset.

Despite the manifold changes that have taken place over the last eighteen months, CIMMYT's research output has largely remained on track. CIMMYT continues to supply its developing country partners with improved germplasm and its upstream research activities continue to produce exciting results. Nevertheless there have been costs to the restructuring process; perhaps the most important being damage to staff morale. A staff survey conducted by the EPMR Panel indicated that staff morale had fallen to very low levels, presumably due to the staff redundancies and restructuring and the uncertainty associated with issues such as the IRRI-CIMMYT alliance. Clearly, this should be an area of major concern for CIMMYT

management. There is no evidence yet that low staff morale has affected CIMMYT's capacity to hire and retain high quality staff. However, if the problem is allowed to continue, this will almost certainly be the result.

## **10.2 CIMMYT Tomorrow**

Notwithstanding the above concerns, it is clear that over the last 18 months CIMMYT has gone through a major transformation; a transformation that is likely to be completed in the next 12 months. Its new mission aligns the Center more closely with the broader CGIAR goals of alleviating poverty, increasing food security and improving sustainability. Its new strategic plan and new program structure emphasize and facilitate interdisciplinary research. It has a significantly younger staff profile, better aligned to its needs, and the staff has improved skills in a range of modern technologies. It also has a new management team in place as well as new scientific leadership. This is a remarkable transformation given the constraints the Center has been under during this time and means that CIMMYT is well placed to face the future. For this, the Center, its Board and Management should be congratulated.

There are, nevertheless, a number of issues that are likely to provide challenges and opportunities for CIMMYT over the next five years. One is the increasingly diffuse focus of the Center's research program. CIMMYT is now smaller than it has been in recent years, yet its research agenda is more diverse than ever before. The Panel acknowledges that the adoption of a diverse research agenda can be an advantage in a system where there is an increasing emphasis on special project funding by donors, research priorities for special projects are often decided on a year-to-year basis, and there is strong competition for funds. The concern is that casting a wide net in search of funds may lead to a very diverse set of activities in a Center, many of which are funded at sub-optimal levels. The Panel also acknowledges that CIMMYT intends to use partnerships to a greater degree to achieve its goals in the future, particularly in areas where it has limited in-house capacity. While this can be a very useful approach, achieving a particular goal can be more, not less, difficult to achieve through a partnership than through in-house capacity alone. This is particularly true for a Center such as CIMMYT where some staff are already having difficulty in maintaining the quality of their existing relationships with partners. These difficulties go straight to the success of the strategic plan, and CIMMYT may need to refine the plan and its implementation on a regular basis once it has its new research programs fully operational.

A second specific issue, but one which was raised by several key CIMMYT stakeholders, is the relative investment by CIMMYT in wheat and maize breeding compared to other areas of research both upstream and downstream. There is concern that germplasm improvement activities have been greatly deemphasized in the new strategic plan and further, that funding for such activities has been more severely cut than other areas of research in the new structure. Improved germplasm has been a key output for CIMMYT since its inception and one on which many developing countries have come to rely. Any threat to CIMMYT's continued role in this area is therefore viewed with great concern. CIMMYT has argued that it can deliver the outcomes its developing country partners require through improved efficiency in its breeding programs, the application of new technologies (for example, MAS), and a change in the mix of products available for use by developing countries (for example,

fewer fixed lines and more segregating populations). However, CIMMYT has a significant communication issue in relation to wheat and maize breeding which it will need to address both now and into the future.

A third specific issue is the need for substantial new investments in CIMMYT for capital goods and equipment. This was raised as an issue in Chapter 6 in relation to the maintenance of research infrastructure, but it is a wider issue than that for the Center. It affects management capacity as well as research capacity. Areas where CIMMYT will require significant new capital investment in the near to medium term include financial and project management systems, bioinformatics and data management, high throughput molecular marker facilities, and greenhouse and field facilities for transgenic research. CIMMYT is unlikely to be able to make a series of large capital investments from traditional sources of funds over the next few years while it is building up its depleted capital reserves to the minimum level recommended by the CGIAR. The Center therefore needs to document its requirements and to seek additional capital support from donors to meet those requirements.

### **10.3 Conclusions**

CIMMYT has undertaken a major transformation which, when it is fully complete, will result in a Center ready and capable of occupying a key and unique global role in wheat and maize research particularly through the use of genetic resources and modern biotechnology to develop and deliver improved germplasm to resource poor farmers. To achieve this high goal requires CIMMYT to improve its governance and management, make significant capital investments in key scientific capacities and fully and successfully implement its new strategy and research structure. While the task ahead is challenging for the Board, management and staff of CIMMYT, it is nevertheless achievable, and once achieved, the EMPR Panel is firmly convinced that the future ahead for CIMMYT is very bright indeed.



## ACKNOWLEDGEMENTS

The EPMR Panel expresses its sincere thanks to the Board, Senior Management and all staff of CIMMYT for their support and assistance during the review. In particular, the Panel wishes to thank Masa Iwanaga, CIMMYT's Director General, Peter Ninnes, Executive Officer, John Dodds, Deputy Director General for Research, and Maarten Van Weerdenburg, Director for Corporate Services and their staff for helping the Panel in the organization and implementation of the review and providing technical assistance. The Panel is also grateful for the Board Chair, Alexander McCalla and Board members for taking their time to interact with the Panel representatives who attended the Board meeting. We also thank Dr. and Mrs. Iwanaga for their warm hospitality during the review.

The Panel was fortunate to have the opportunity to exchange ideas with CIMMYT's Mexican partners and stakeholders. We extend our thanks to all who attended these meetings, in particular Lic. Guadalupe Sánchez, Ministry of Foreign Affairs, Dr Victor Villalobos Arámbula, Ministry of Agriculture, Dr. Pedro Brajcich Gallegos, Director General INIFAP, and Dr. Benjamín Figueroa Sandoval, Director General of Colegio de Postgraduados, Montecillo.

One Panel member visited CIMMYT's regional office and partners in Bangladesh. Dr. Craig Meisner is warmly thanked for organising and coordinating the visit. Two Panel members paid a visit to three eastern African countries: Mozambique, Zimbabwe and Kenya. Dr. Marianne Bänzinger is thanked for the excellent arrangements for the successful visit. The Panel also wishes to thank Drs. Mulugetta Mekuria, Alpha Diallo, Hugo de Groote, Stephen Waddington, Pat Wall, and Augustine S. Langyintou, staff members of CIMMYT for their assistance, information and time spent with the Panel members. The Panel members appreciated very much the opportunity to meet with Dr. Calisto A.L.F. Bias, Director of INIA in Mozambique, and Dr. Romano Kiome, Director General of KARI in Kenya.

Thanks are due to all the CIMMYT research and management staff that provided both time and materials for the Panel members for information and insight. Many CIMMYT staff at the Headquarters contributed to helping the Panel during its stay in many ways and helping its work tremendously. All of them deserve our warmest appreciation. We owe special thanks to the staff at the CIMMYT Guesthouse and Cafeteria.

It is the Panel's pleasure to thank the Science Council Secretariat, especially Sirkka Immonen, who assisted the Panel throughout the review. Thanks go to the CGIAR Secretariat, especially to Selcuk Özgediz and Manny Lantin for providing documentation and support to the Panel. The Panel also thanks Irmi Braun-Castaldi from the Science Council Secretariat for travel and logistical arrangements.



## APPENDICES

## PANEL COMPOSITION AND BIOGRAPHICAL INFORMATION

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**Position:** Professor Emeritus; Director, Plant Breeding Solutions, Pty Ltd.

**Expertise:** Genetics and Plant Breeding

**Education:** Ph.D., Genetics, University of California, Davis (1968); B.Sc. Agr. Agronomy, University of Sydney (1963).

**Experience:** Retired from University of Sydney; currently part-time consultancy with Plant Breeding Solutions. 1991-2003: Professor of Plant Breeding and Director, Plant Breeding Institute, The University of Sydney, NSW Australia. 1986-91: Professor of Agronomy, University of Adelaide. 1981-86: Director, University of Sydney, Wheat Research Center, Narrabri. 1970-81: Research Scientist and Leader Genetic Resources Section, CSIRO, Division of Plant Industry. 1968-69: Postdoctoral Fellow in Genetics, University of California, Davis. Member of South Australian Wheat & Barley Research Committees; Member Australian Green Legumes Research Council; Founding Director of the Australian Grains Research & Development Corporation; Director of Sunprime Seeds Pty Ltd; Member of Board of Trustees of IPGRI and ICRISAT; Panel Member, CCER, Wheat Germplasm Improvement Sub-Program, CIMMYT; Panel Member, 4th CIMMYT EPMR and 4th ICARDA EPMR. Fellow of the Australian Academy of Technological Sciences and Engineering and member of several scientific societies. Author of numerous publications.

Name: CAP, Eugenio Julio (Argentina)

**Position:** Director, Institute of Economics and Sociology, INTA, Argentina

**Expertise:** Agricultural economics, technology adoption, trade

**Education:** Ph.D. Agricultural and Applied Economics. University of Minnesota (1992); MSc, Vegetable Crops, University of California, Davis (1982); Ingeniero Agrónomo. Facultad de Agronomía y Veterinaria (School of Agriculture and Veterinary Medicine), University of Buenos Aires (1973)

**Experience:** Current position since 2000; 1998-2000: Assistant to the Director General of INTA for Strategic Affairs. 1992-1998: Director of Strategic Planning, INTA. 1987-1992: Graduate Studies at the University of Minnesota, Saint Paul and Minneapolis, USA. 1977-1984: Head of the Rural Extension Service. INTA. Florencio Varela, Provincia de Buenos Aires, Argentina (1980-82: Graduate Studies at UC Davis). 1973-1977: Extension Officer, INTA, Provincia de Buenos Aires, Argentina. 1992-93: Member of the International Coordinating Committee of the Institutional Development Subprogram at PROCISUR, Montevideo, Uruguay. 1993-96: National Coordinator for Argentina in the Institutional Development Subprogram at PROCISUR. Has received an award for Outstanding Doctoral Dissertation by the Department of Agricultural and Applied Economics, University of Minnesota. Nomination to the National Outstanding Doctoral Dissertation Competition of the AAEE (American Agricultural Economists Association). Memberships include: Gamma Sigma Delta, The Honor Society of Agriculture (1991); Honor List. Department of Agricultural and Applied Economics. University of Minnesota (1990 and 1991). Consultancies include: IADB in Venezuela, Uruguay and Washington, D.C., World Bank (in El Salvador), IDB/FONTAGRO, World Resources Institute and FAO (In Uruguay and Argentina).

Name: UKAI, Shu (Japan)

**Position:** Professor in Crop Physiology, School of Land and Food Sciences, University of Queensland, Brisbane, Australia

**Expertise:** Crop physiology

**Education:** PhD in Agronomy, University of Adelaide, 1975; BAgrSc, The University of Tokyo, 1969

**Experience:** Present position since 2002. 1992-2001: Associate Professor in Crop Physiology, University of Queensland; 1986-91: Senior Lecturer in Crop Science, University of Queensland; 1978-85: Lecturer in Crop Agronomy, University of Queensland; 1976-78: Tutor, School of Biological

Science, Macquarie University, Sydney; 1975: CSIRO Postdoctoral Fellow, University of California, Davis, USA. Research interests focus on crop physiology, particularly tolerance to water and low temperature stresses. Experience of leading several research projects include: 2002, Rockefeller Project on selection of drought tolerant rice genotypes; 2000, GRDC project on frost resistance in wheat (with Naidu Bodapati); 2000, ACIAR Project 'Increasing production of lowland rice in Laos, Cambodia and Australia'; 1998- 2000, ARC Project 'Nutrient requirement of tropical crops in Indonesia and Australia'; 1996-2000, ACIAR Project 'Plant breeding strategies for rainfed lowland rice in Northeast Thailand and Laos'; 1992-1996, ACIAR Project 'Plant improvement for rainfed lowland rice in drought prone areas in Thailand and Laos'. Author of over 100 journal papers published in Field Crops Research, Australian Journal of Agricultural Research and other journals. Senior editor of 4 books including Special issues of Field Crops Research.

Name: GOERTZ, Peter G. (Germany)

**Position:** Director of Research for Maize Breeding in SWS GbR, Rastatt, Germany (Research Company of SAATEN-UNION GROUP)

**Expertise:** Plant breeding and seed production

**Education:** Ph.D. in Plant Breeding and Agronomy, University of Hohenheim (1978; research topic: development of maize concept for the Andean Highlands); M.Sc. in Agronomy, University of Hohenheim (1974); B.Sc. in Agriculture, Agricultural College of Bad Kreuznach (1971)

**Experience:** Present position since 1997. 1982-96: Head of Plant Breeding Section at SWS Seed Company in Rastatt. 1977-81: Agronomist/Breeder; Maize Research Team, CIMMYT, Mexico. 1975-76: Research Fellow, CIMMYT. 1974-75: Research Assistant, Institute of Plant Breeding, University of Hohenheim. Dr. Goertz has carried out consulting missions in various parts of the world (Latin America, Asia and Africa) mainly on maize but also on irrigation, agroforestry and biotechnology. The focus of his work has been on the development of proprietary germplasm for temperate growing areas; the selection of maize inbreds for the maize seed industry in Europe, USA and China; the design of specific maize breeding programs for silage quality, food grade quality and natural resistance mechanisms; the release of new varieties and hybrids to seed markets (EU, Canada, USA and various Eastern European countries); the development of proprietary germplasm in durum-wheat; and to the use of worldwide maize genetic resources in applied maize breeding programs.

Name: ROBINSON, Maureen (USA)

**Position:** Consultant

**Expertise:** Governance, management, leadership and organizational development

**Education:** B.A., The George Washington University (1974)

**Experience:** Since 1998, private consulting practice; 1990-1998, founding Director of Education, National Center for Non-profit Boards; 1987-1990, Special Assistant, Office of the Assistant Secretary for Museums, Smithsonian Institution; 1979-1985, Director of Government Affairs; 1975-1979, Associate Editor of Publications, American Association of Museums. Publications: Non-profit Boards that Work: The End of One-Size-Fits-All Governance, John Wiley & Sons, 2001; columnist, Contributions Magazine, 2002-present, writer/editor, CGIAR Board Reference Guides, (7 booklets), 1997; Developing the Non-profit Board: Strategies for Educating and Motivating Board Members, National Center for Non-profit Boards, 1994; The Chief Executive's Role in Developing the Non-profit Board, National Center for Non-profit Boards, 1998.

Name: SAYEGH, Edward (Lebanon)

**Position:** Chief Executive Officer and Founder of the Center for Non-Profit Governance, Lebanon and USA.

**Expertise:** International relations, management and administration, financial and human resources management, operational controls

**Education:** Advance Management Program, The Wharton School of the University of Pennsylvania, USA (1994); MSc in Management (Sloan Fellow), London Business School (1986); BSc, American University of Beirut (1968)

**Experience:** Present position since 2004. 1998-2003: Associate Director General and Board Secretary, WorldFish Center. Took the lead the negotiating the headquarters agreement with the Malaysia Government, relocating the Center from the Philippines to Malaysia and supervising the building of the Center headquarters in Penang, Malaysia including hiring of staff; 1987-97: Treasurer and Director for Finance with Administrative Functions, IRRI; 1978-87: Financial Controller and Treasurer also handled Administration (1984-87), ICARDA; 1978-81: Station Financial Officer 1966-77: Senior Financial Officer/Acting Comptroller at the American University of Beirut; and Partner in an auditing and accounting firm in Beirut; Consultant, General Motors (1986), USA and to various donors on governance, general management and financial management (1986-present); Vice Board Chair and Chair of the Audit Committee of the Association of International Agricultural Research Centers (1990-2002). Member of the American Management Association, British Institute of Management and Institute of Management Accountants, USA.

**TERMS OF REFERENCE  
FOR EXTERNAL PROGRAM AND MANAGEMENT REVIEWS  
OF CGIAR CENTERS**

**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 centers in agriculture, forestry and fisheries. The CGIAR aims, through its support to the Centers, to contribute to promoting sustainable agriculture for food security in developing countries. Because the Centers constitute the core of the CGIAR, the effectiveness of each Center is crucial to the continued success of the CGIAR (as a System).
2. Each Center 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 Center. To ensure accountability in an essentially decentralized system, each Center is expected to be responsive to the CGIAR, which provides financial support for its work.
3. The CGIAR has established a tradition of External Program and Management Reviews (EPMRs) to provide a mechanism of transparency and accountability to the Members and other stakeholders of the CGIAR System. EPMRs are the joint responsibility of SC and the CGIAR Secretariat, and are conducted for each Center approximately every five years. As each Center is autonomous, EPMRs provide a measure of central oversight and serve as an essential component of the CGIAR's accountability system.

**Integrated System of Reviews of Each Center**

4. Besides the EPMRs, Center Commissioned External Reviews (CCERs) are undertaken at each Center. These CCERs are commissioned by the Center Boards to periodically assess the quality and effectiveness of particular aspects of a Center's work. The terms of reference (ToRs) for each CCER are determined by the Center, based on broad principles endorsed by the CGIAR at ICW95 (ref. document entitled Improving the Quality and Consistency of CGIAR's External Center Reviews, dated October 24, 1995).
5. EPMRs complement the CCERs by providing a CGIAR-commissioned and comprehensive external assessment of the Center's program and management, especially its future directions and the quality and relevance of its research. The ToRs for the EPMRs (which update the "standard ToRs" endorsed by the CGIAR at MTM95) are provided below. Guidelines for undertaking the reviews are issued separately.

**TERMS OF REFERENCE**

**Objectives and Scope**

6. EPMRs seek 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 Center is doing its work effectively and efficiently. EPMRs are both retrospective and prospective; and help ensure the Centers' excellence, relevance and continued viability, and the CGIAR System's

coherence. Each review is expected to be strategic in orientation and as comprehensive as the situation warrants.

7. The broad objectives of EPMRs are to: a) provide CGIAR members with an independent and rigorous assessment of the institutional health and contribution of a Center they are supporting; and b) to provide the Center and its collaborators with assessment information that complements or validates their own evaluation efforts, including the CCERs.
8. The EPMR panel is specifically charged to assess the following:
  - a) The Center's mission, strategy and priorities in the context of the CGIAR's priorities and strategies;
  - b) The quality and relevance of the science undertaken, including the effectiveness and potential impact of the Center's completed and ongoing research;
  - c) The effectiveness and efficiency of management, including the mechanisms and processes for ensuring quality; and
  - d) The accomplishments and impact of the Center's research and related activities.
9. The topics expected to be covered by the EPMRs are listed below.

#### TOPICS TO BE COVERED

##### A. Mission, Strategy and Priorities

The continuing appropriateness of the Center's mission in light of important changes in the Center and its external environment since the previous external review.

The policies, strategies, and priorities of the Center, 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 Center's strategy and priorities, considering alternative sources of supply and the benefits of partnerships with others.

##### B. Quality and Relevance

The quality and relevance of the science practised at the Center.

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

##### C. Effectiveness and Efficiency of Management

The performance of the Center's Board in governing the Center, the effectiveness of leadership throughout the Center, and the suitability of the organization's culture to its mission.

The adequacy of the Center's organizational structure and the mechanisms in place to manage, coordinate and ensure the excellence of the research programs and related activities.

The adequacy of resources (financial, human, physical and information) available and the effectiveness and efficiency of their management.

The effectiveness of the Center's relationships with relevant research partners and other stakeholders of the CGIAR System.

D. Accomplishments and Impact

Recent achievements of the Center in research and other areas.

The effectiveness of the Center's programs in terms of their impact and contribution to the achievement of the mission and goals of the CGIAR.

## GUIDELINES FOR EXTERNAL PROGRAM AND MANAGEMENT REVIEWS OF CGIAR CENTERS<sup>9</sup>

### INTRODUCTION

1. External Program and Management Reviews (EPMRs) of CGIAR-supported Centers are carried out in accordance with the process Guidelines outlined below and the Terms of Reference (TORs) issued separately. These guidelines were essentially drawn from those that governed the external reviews of Centers for many years. Some changes have been introduced primarily to make these Guidelines consistent with the current practices and recent changes in the CGIAR.

Each review is expected to be strategic in orientation and as comprehensive as the situation warrants. To be credible and acceptable, all reviews 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, Center 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 Center management and staff, and will be willingly, or even enthusiastically, implemented.

### GUIDELINES

3. EPMRs are expected to maintain high standards of quality and rigor, and be conducted by an independent and objective panel. The EPMR is expected to assess the Center in terms of its: mission and strategy, program priorities; quality and relevance of its science; achievements and impact; and effectiveness and efficiency of 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 an EPMR are: the EPMR panel Chair and members; the CGIAR Members, the Science Council and its Secretariat, and the CGIAR Secretariat; members of the Center's Board, management and staff; the panel's support team of external consultants and resource persons from the SC and CGIAR Secretariats; and the Center's many partners at the local, national, regional and international levels.

Roles and Responsibilities

5. The CGIAR, SC and the Secretariats. The CGIAR establishes external review policies for the System, and EPMRs are conducted on its behalf, in accordance with the TORs endorsed by the Group. For each review, CGIAR Members are requested to propose Center-specific issues for the panel to consider, and receive the review report. The SC commissions the EPMR generally according to the 5-yearly schedule. The SC and the CGIAR Secretariat are responsible for the coordination and management of the EPMR and provide guidance on matters of review design and panel composition,

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<sup>9</sup>Revised in 2003

in consultation with the Center's Board and management. The SC focuses on all programmatic aspects of the review, while the CGIAR Secretariat focuses on the governance and management aspects of the review.

6. Senior staff members of the SC and CGIAR Secretariats serve as resource persons throughout the review process. The SC Secretariat resource person accompanies the panel Chair and members during their visits to the Center and occasionally on field visits. He/she provides substantive briefings on technical matters and on the recent developments in the CGIAR, compiles documents relevant for program evaluation and assists the panel on process matters, including the logistical aspects of report preparation and production. The CGIAR Secretariat resource person compiles documents related to CGIAR governance and management and assists the panel in management aspects of the review. However, to help safeguard the EPMR panel's independence and objectivity, the Secretariats' resource persons are 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 SC in consultation with the CGIAR Secretariat and the Center. The Chair's involvement begins early on, when he/she is consulted regarding panel composition, and briefed by SC Chair about the review process and key issues and concerns regarding the Center. 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 EPMRs. Given the magnitude of the task, the complexity of the issues, the fact that many panel members may be unfamiliar with the CGIAR, the importance of maintaining dialogue with the Center, 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. Staff provided by the Secretariats assist 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 persons from the Secretariats (and sometimes a SC member) support the panel's efforts as members of a team, ultimately the panel is responsible for formulating the assessment and recommendations of the EPMR report.

9. The Center Board, Management and Staff. The Center'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 Center and to the field. Once the review is underway, it entails a significant degree of interaction between the EPMR panel and Center staff, as part of a valuable two-way learning experience. Throughout the process, the collaboration and inputs of Center management and staff are essential for the review to run smoothly and for the report to be credible and acceptable.

10. The Center'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 Centers, and their input is considered essential for the viability of the EPMR review process. As part of the review, representatives of such organizations are consulted for their views on the Center's strategy, programs 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 Centers and other relevant institutions with which the Center collaborates. Such consultations are valuable as a means of assessing the Center's role in the CGIAR

and in the global context. Given the vast number of collaborators or potential partners of a Center, such meetings must be limited. Their outcome is considered important, however, and is expected to feed into the panel's assessment of the Center.

#### Panel Composition and Report

11. Panel Composition. The review panel is composed of experts in program and management areas relevant to the Center 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 Center. 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 EPMR panel normally consists of five members, including the Chair. Panel members are generally selected for their ability to focus on the institution-wide issues relating to the Center's mission, strategy, priorities, programs and management. 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 Center being reviewed; and c) at least one panel member has expertise in institutional governance and/or research organization and management.

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

14. Because research in the CGIAR System is a long-term undertaking, the problems the Center is working on may not have visible outputs until several years from now. For this reason, the review report is expected to provide convincing evidence on the quality and relevance 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 Center's current program of work.

15. Although the EPMR 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 Center and makes recommendations on how the Center (or the CGIAR) could address them. It provides assurances and convincing evidence to indicate that other aspects of the Center's programs 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 Center's internal review system on which the EPMR was based, and on how well the Center has addressed the recommendations of the other reviews commissioned by the Center.

#### Integration with Center 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 EPMR. The CCERs are undertaken by specialized external consultants, assisted by members of the Center Board and staff as resource persons (not participants). They are expected to cover at least portions of the Center's main research programs (including their relevance, direction, science quality, achievements, and, to the extent possible, impact) as well as

aspects of Center management (including governance, research organization and management, finance and human resource management).

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

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

19. The EPMR, 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 Center. While the Center'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 Center's quality assurance system, including the processes for undertaking CCERs and other mechanisms of peer review, are the responsibility of the EPMR panel.

#### Board Assessment Visit

20. Interactions between the Center 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 Center (see below), the panel Chair along with a panel member or consultant specializing on governance issues attend a Board meeting, and interview Trustees concerning Board and Center matters. This 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 EPMR.

21. The visit also provides the panel Chair and selected members or consultant an opportunity to review the 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. The preliminary written assessment of the Board is made available to the panel (but not the Center), and is modified as appropriate during the main phase of the EPMR (see below).

In assessing Board effectiveness and operations, the panel takes into account the key legal documents governing the Center - particularly the Establishment Agreement, the Headquarters Agreement, and the Constitution of the Center. It also keeps in mind the main provisions of the Guidelines for CGIAR Boards endorsed at MTM95, particularly the guideline on the "Role, Responsibilities and Accountability of Center Boards of Trustees".

## First Panel Visit and Briefing

23. Following the Board assessment visit (or sometimes coinciding with it), the full panel undertakes its first visit to the Center headquarters for about one week for initial discussions with Center management, staff and Board members (when the visit coincides with the meeting of the Executive or Program Committees of the Board). This initial phase visit enables the panel to obtain an overview of the Center's current activities and future plans, to identify strategic issues to be covered by the review team, and to 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. During the visit, and virtually before that, the panel receives detailed briefings from the SC Secretariat, from CGIAR Secretariat and Center management on the recent developments in the CGIAR and the Center being reviewed.

24. The briefing provided by the SC Secretariat resource person cover technical matters such as the CGIAR's mission, priorities, strategies, programs and impact assessments and an overview of the recent development in the CGIAR. The CGIAR Secretariat resource person provides support to the briefing on management matters such as the CGIAR's governance, organization, finance and human resources. These briefings also cover the CGIAR's expectations regarding the scope and process of the review (as outlined in the TORs and Guidelines for EPMRs); as well as an overview of program and management issues of relevance to the Center being reviewed. The SC Secretariat resource person also provides substantive and process-oriented support as requested by the panel Chair. He/she serves as the panel Secretary.

25. The panel then receives briefings from Center management and senior staff on the Center's strategy, priorities, programs, governance and management. These briefings focus particularly on the Center's recent developments and achievements, CCER findings and conclusions, and future plans. In addition, the panel seeks additional information from other Center staff, on a selective basis, as needed; and invites Center staff members, either individually or in small groups, to voluntarily share their concerns, if any, regarding Center-wide program and 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 Center's work, the Center is expected to make available for the SC Secretariat and panel members, in advance of the first visit, the recent CCERs and other assessments undertaken, as well as other relevant Center-related documentation (such as the latest Strategy document, Medium Term Plan, Program and Funding Request, and other relevant policy documents or analytical papers prepared by the Center). Many of these documents are off the shelf, and do not need to be especially prepared for the EPMR. The Center can also be requested to provide short documents on strategy and vision, detailed documents on outputs and achievements, measures of esteem for professional staff, and other documents requested by the panel Chair to be prepared for the EPMR specifically.

27. Towards the end of this first visit to the Center, and virtually between the initial and main phases, the panel members 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 initial phase and the main phase.

### Field Visits

28. To help ensure that the EPMR panel's assessments are adequately grounded in the reality of the Center's circumstances, the panel is expected to undertake country field visits, jointly determined by the Center, panel Chair and the SC Secretariat. The field visits cover the major non-headquarters based operations of the Center, so as to provide a realistic assessment of the Center'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 for about 3-5 days each, and are undertaken before the main phase of the review.

29. A senior staff member from the Center 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 SC Secretariat helps coordinate the field visits and may accompany the panel members, as requested by the panel Chair. These visits supplement any surveys of NARS and Center staff, organized by the resource person from the SC Secretariat in advance of the main phase.

### Main Phase and Report Writing

30. The EPMR panel visits the Center for a period of about 10-12 days to undertake the main phase of the review. At the end of this visit, final draft chapters are shared with the Center management to ensure their accuracy, and the panel Chair presents the main findings and recommendations to the Center management and staff. The Center may invite Board members from the host country to attend the discussion with the Panel.

31. The EPMR panel's report is expected to focus on the four topics covered in the TORs - namely, the Center's: a) mission, strategy and priorities; b) quality and relevance of science; c) effectiveness and efficiency of 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 program 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 60-70 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 EPMR panel's report is expected to compensate for gaps through its own analysis and assessment.

33. The panel will prepare final drafts of the EPMR report during the main phase and share them with the Center management. The final EPMR report is expected to be completed at the SC Secretariat within two weeks from the main visit. It will then be sent to the Center Board and management. At that time the panel Chair formally transmits the document to the SC Chair and the CGIAR Director.

### Response and Follow-up

34. The Board and management of the Center under review are expected to submit a formal written response to the EPMR report, addressed to the SC and the CGIAR Secretariat. The SC discusses the report in the presence of the panel Chair and representatives from the Center (including the Board Chair and Director General), and prepares a commentary, in collaboration with the CGIAR Secretariat, including recommendations for follow-up action by the CGIAR or the Center. The EPMR

report, the Center's written response, and the SC commentary are then submitted to the ExCo. It is discussed by the Program and Finance Committees of the ExCo, and the ExCo formulates recommendations to the Group.

35. As a final step in the review process, the CGIAR discusses the EPMR report and the accompanying comments, including ExCo recommendations, usually at its annual meeting, and agrees on follow-up action. Occasionally, this follow-up includes a CGIAR-commissioned Mid-Term Review (MTR) to monitor closely the Center's handling of major concerns raised during the EPMR. The Center's progress in implementing the recommendations of the EPMR is followed-up by the ExCo, which reports on the Center's progress in meeting the agreed objectives. Follow-up is done also by the next external review panel five years later, which includes in its external report a mandatory Annex on Center compliance to the previous external review's recommendations - thus completing the external review cycle.

#### CONCLUSION

36. EPMRs provide the CGIAR and other stakeholders very valuable information on the accomplishments and future prospects of each Center 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 Center's Board, management, staff and partners - about the Center's direction and its institutional capacity to produce the desired research 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 EPMR recommendations. In any case, the Center and the System benefit from such reviews.

**ITINERARY OF THE EPMR PANEL**

The Panel Chair and the two members responsible for the Management and Governance aspects of the review attended CIMMYT's Board meeting held at CIMMYT Headquarters in El Batan, Mexico 22-23 October, 2004.

The whole Panel, except one absent for personal reasons, visited CIMMYT Headquarters during the Initial Phase from 22 to 27 November, 2004. During this time the CIMMYT Senior Management and Program staff provided briefings on CIMMYT's strategic planning process, its new mission, vision, strategy and new program structure, its achievements and management.

Panel members subsequently visited CIMMYT's operations in East Africa (Mozambique, Zimbabwe and Kenya) and south Asia (Bangladesh) to interact with a cross section of CIMMYT partners.

The Panel members prepared drafts sections for the report prior to arriving to the Center for the Main Phase, which was held from 14 to 24 February, 2005, at CIMMYT Headquarters.

The Panel Chair and two Panel Members met key government officials at the Ministries of Foreign Affairs and Agriculture, and the Mexican NARI, INIFAP, in Mexico City, and visited the local Postgraduate College with which CIMMYT has had a long and fruitful relationship.

During the Main Phase the Panel sought clarification of outstanding issues and produced the final draft of this report. Prior to presenting the final report to the Center, early drafts of the report had been shared with the Senior Management for any comments, particularly on errors of fact.

The Panel presented the major findings of the report to CIMMYT staff on 25th February. The report was finalised within week from departing CIMMYT

LIST OF DOCUMENTS PROVIDED TO THE PANEL<sup>11</sup>**A. Documents Provided by the SC and CGIAR Secretariats***To All Panel Members:*

1. Terms of Reference and Guidelines for External Program and Management Reviews of CGIAR Centers.
2. Report of the Fourth External Program and Management Review report of the International Maize and Wheat Improvement Center (CIMMYT).
3. Report of the Sixth External Program and Management Review report of the International Rice Research Institute (IRRI).
4. Most recent CGIAR stripe studies involving the Center (to all or relevant Panel members):
  - Systemwide Review of Plant Breeding Methodologies in the CGIAR (October 2001);
  - Report of the CIMMYT Sub panel on the Systemwide Review of Plant Breeding Methodologies in the CGIAR (March 2000);
  - Chapter 4: Wheat by P.W. Helsey, M.A. Lantican and H.J. Dubin;
  - Chapter 7: Impacts of CIMMYT Maize Breeding Research by M. Morris, M. Mekuria and R. Gerpacio;
  - Assessing the Impact of the Green Revolution, 1960 to 2000.
5. Toward a New Vision and Strategy for the CGIAR.
6. Summary report on Developing GCIAR System Priorities for Research.
7. Extracts from SC Commentaries on CIMMYT Medium-Term Plans.
8. CGIAR Annual Report.
9. CGIAR Directory.
10. Summary Record of Proceedings of CGIAR Meetings

*Supplementary documents, to relevant Panel Members:*

11. CGIAR Boards of Trustees Directory, 2002.
12. CGIAR Financial Guidelines and Manuals.
13. Reference Guides for CGIAR International Agricultural Research Centers and their Boards of Trustees:
  - Guide 1: The Role, Responsibilities, and Accountability of Center Boards of Trustees;
  - Guide 2: The Role of the Board Chair;
  - Guide 3: Creating a Well-Balanced Board;
  - Guide 4: Building Effective Board Committees;
  - Guide 5: Choosing a Director General: The Search and Selection Process;
  - Guide 6: Evaluating the Director General: The Assessment Process;

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<sup>11</sup> All these documents were posted at the CIMMYT EPMR Website established for the Panel. Panel members were provided with several other documents, including scientific article, some of which are referred to in the Report.

- Guide 7: Board Self-Assessment.
14. Committees and Units of the CGIAR: Roles, Responsibilities and Procedures:

**B. CIMMYT Documents to EPMR Team**

15. Charter and Other Basic Documents established by CIMMYT:
- Declaraciones for CIMMYT, Int.
  - Agreement CIMMYT & Mexico
  - Agreement UNDP & CIMMYT
  - CIMMYT Charter
  - CIMMYT Status
16. Composition of CIMMYT Board of Trustees (last five years):
- Board Membership 2000-2004
  - Board Committees 2000-2004
17. Board Handbook and Rules of Procedure
18. Information Management Systems and Procedures
19. Board of Trustees Minutes (since last External Review):
- Audit Committee Minutes 1997-2004
  - Finance and Administration Minutes 1997-2004
  - Program Committee Minutes 1997-2004
  - Full Board Minutes – April 1997 to March 2004
20. CIMMYT Annual Reports:
- Adding Value for Development: CIMMYT Annual Report 2003-2004;
  - CIMMYT in 2002-2003. Innovation for Development
21. Board-Approved Strategic Plan
22. CIMMYT Medium-Term Plan
23. CIMMYT Organization Chart
24. Description of New Decentralized Structure
25. List of Professional Staff (national and international)
26. Center-Commissioned External Review (CCER) Reports:
- Rice-Wheat Consortium
  - Wheat CCER Report
  - Maize CCER Report
  - CCER-MTP Project-based management
27. Summary of Actions in Response to Last EPMR
28. Agreements for Activities with Other Centers and Institutions
29. Tables of Allowances, Benefits and Salary Ranges:
- Summary of principal benefits for IRS
  - IRS Salary Scale
  - Summary of principal benefits for NRS based in Mexico
  - NRS Salary Scale
  - Summary of principal benefits for NRS based in the regional offices
30. Table of Personal Data on Professional Staff by Program
31. Table Summarizing Staff Turnover (last five years)

32. Summary of Staff Reduction and Rationalization Program
33. International Staff Vacancies
34. Staff Manual:
  - IRS
  - NRS based in Mexico, Nepal, Bangladesh, India and Zimbabwe
35. Local Compensation Surveys:
  - CGIAR Review of Total Compensation
  - Review of NRS Compensation at Mexico
  - Zimbabwe Compensation Survey
  - Zimbabwe Compensation Survey
36. Performance Management System:
  - IRS Performance Assessment and Appraisal
  - NRS Form – Technical Staff
  - NRS Form – Administrative Staff
  - NRS Form – Head, Supervisor and Professional Staff
37. Promotion and Staff Development Policies:
  - IRS Compensation and Classification and Compensation Manual
  - NRS based in Mexico
  - NRS based in Nepal and Zimbabwe
38. Recruitment Strategy for Implementation of the New Strategy
39. Succession Planning Process and Plans for Continuity
40. Reports of External Auditors:
  - Independent auditors' report to the CIMMYT Board of Trustees
  - Report to the Audit Committee Observations and Recommendations arising from the 2003 and 2002 Audits
  - Notes to combined financial statements
41. Most Recent Internal Audit Reports
42. Major Internal Audit Recommendations/Findings:
  - Report on A Review of Project Costing. Recommendations and Management's Response
  - Major Internal audit Recommendations 2002-2004
43. Summary Revenues and Spending by Funding Type
44. List of Loans and Credit Facilities
45. Financial Management/Information Management Systems
46. Financial Package Provided to the Board of Trustees
47. Summary of Indirect Cost Recovery System
48. Board-Approved Investment Policy
49. Center Priority Setting and Resource Allocation
50. Current Projects
51. Project Proposal Costing
52. Corporate Services Division Structure and Organization
53. Functions and Responsibilities of IT and Communication
54. List of Center Current Policies and Guidelines

55. Current Matrix of Authority Levels
56. List of Systemwide Activities
57. Challenge Program Governance and Management
58. Physical Plant and Infrastructure Management and Maintenance
59. Farm Operations and Management
60. Fifth EPMR Science Briefing
61. CVs of International Research Staff
62. CIMMYT IRS List
63. Research Highlights: (Biotechnology, Economics, Maize, Natural Resources, Wheat)

**CIMMYT'S RESPONSE AND 2004 UPDATE TO THE RECOMMENDATIONS OF THE  
FOURTH EXTERNAL PROGRAM AND MANAGEMENT REVIEW, AND THE 5<sup>TH</sup> EPMR  
PANEL'S OBSERVATIONS**

***Recommendation 1***

The Panel **recommends** that the Wheat Program initiate an integrated global program to monitor the racial composition of the populations of stem, leaf; and stripe rust in the major epidemiological regions of the developing world, and help develop complementary research capacity in key NARS.

**Response**

The wheat program proposes a strategy to launch an integrated global epidemiology based on nine regions, each with a coordination center and laboratory base. Pathogenicity surveys through race analysis and adult plant reactions would then be used for monitoring through a system of trap nurseries. NARS, in many cases, have trained pathologist and CIMMYT will seek to enhance this capacity.

**Action since 1998**

A global network for rust monitoring and racial virulence studies has been established however, to a certain extent, the network is hampered by global phytosanitary requirements. At the same time, it is noted that capacity building in key NARS [Kenya, Turkey and Central Asia] will reduce the need for exchange of isolates and so help overcome the phytosanitary barriers.

**Panel observations:**

A global network for rust monitoring has been established using regional rust nurseries (GRMN: Global Rust Monitoring Nursery). The system, which involves cooperative arrangements with some 30 NARS, appears to be working well.

***Recommendation 2***

The Panel **recommends** that the Wheat Program move to develop breeding strategies that guarantee CIMMYT germplasm carries effective combinations of genes to all three rust diseases.

**Response**

Significant progress has been made; for example, it is widely recognized that CIMMYT's breeding program already combines McFadden's Hope and Brazilian's Frontana. In the past twenty years, no major epidemic of the stem rust or leaf rust has been reported. Our genetic analyses indicate that we have incorporated six genes (including Sr2) to stem rust and at least ten minor genes to leaf rust. CIMMYT is now developing conventional pathological markers and molecular markers to identify top crosses with yellow rust durability.

**Action since 1998**

Minor gene durable resistance is being incorporated into the breeding program for yellow rust, stripe rust and leaf rust. The shuttle breeding methodology has enabled assessment of leaf and yellow rust at both Toluca and Obregon; two sites quite different agroecologically. In addition, there is a considerable effort in Biotechnology into identifying markers for durable resistance in two major complexes for leaf rust (Lr34) and yellow rust (Yr46).

**Panel observations**

CIMMYT is working to incorporate durable resistance for all three rusts into advanced germplasm.

***Recommendation 3***

The Panel **recommends** that the Wheat Program develop full costing of the output of its present wheat, triticale, and barley breeding programs and examine potential cost benefits of the incorporation of double haploid and marker assisted selection technologies in these breeding programs.

## Response

CIMMYT believes that the approach described in this recommendation is part of effective research management. We also note recommendations 7 and 9 in which it is implicit that biotechnology and genetic engineering will be incorporated into mainstream maize and wheat breeding efforts. Recent studies at CIMMYT have shown encouraging results for the double haploid system, and we believe that it may be efficient for characters such as quality and disease resistance.

## Action since 1998

There has been some work on costing new technologies with the Economics Program and also on a simulation project (GRDC-funded) that is modelling breeding methodologies to determine the most efficient interventions, especially in the use of molecular markers. CIMMYT is planning to develop more accurate costing of field plots based on a model in use in Australia.

## Panel observations

Despite the fact that CIMMYT Management initially saw the approach described in this Recommendation as part of effective management, 7 years later it still has not been done. This failure restricts the capacity of CIMMYT to use full cost recovery for the breeding components of projects financed by special project or restricted funds. It also limits the capacity of breeders to make rational decisions based on cost as to when and where to replace established technologies (e.g. disease testing in the field) with new technologies (e.g. molecular markers for disease resistance).

***Recommendation 4***

The Panel **recommends** that the Wheat Program make a concerted effort to seek additional funding for triticale and barley research without which the future viability of these programs is at risk. In the case of barley this needs to be done in close collaboration with ICARDA. If this is not possible, or not successful, then serious consideration will need to be given to the discontinuation of the breeding of these crops.

## Response

CIMMYT's agrees that extra funds are needed for the barley and triticale programs particularly in the area of adaptive research however we also consider that the current effort is viable.

## Action since 1998

Additional funding for triticale and barley has been available recently however, the funding of these two crops continues to be a challenge. Budget allocations for triticale have been severely reduced to the point where only a basic maintenance breeding program is underway.

## Panel observations

Funding for triticale and barley research remains a significant challenge for CIMMYT. Both are only a minor component of the Center's overall program but both are important, or potentially important, regionally. It is not clear from CIMMYT's new strategic plan where projects on these fit in or how they will be funded in the future.

**Recommendation 5**

The Panel **recommends** that the Maize Program place greater emphasis on the development of new heterotic populations that incorporate both improved yield potential and increased stress tolerance and make these populations available to NARS and the private sector.

## Response

CIMMYT agrees that the development of populations in heterotic pairs increases the possibility of obtaining lines for each population that are heterotic to each other however notes that this is not guaranteed. We have accumulated substantial evidence that a high and acceptable level of heterosis can be obtained between lines from the same population. Nonetheless, we plan to augment heterosis by pairing populations and using reciprocal recurrent selection to improve the probability of heterotic combinations between lines derived from that pair.

## Action since 1998

This recommendation has been taken on board by the Director of the Maize Program since he assumed leadership in 1998 and since then the program has increased its emphasis on population development in comparison with the development of lines and hybrids. A science review of the Maize Program in 2002 had also assessed this recommendation and observed that, indeed, there has been significant progress with population development and that there are now a greater number of gene pools and populations being improved using reciprocal recurrent selection for development of OPVs, synthetics, and hybrids.

## Panel observations

This Recommendation has been largely achieved and in maize breeding at CIMMYT increased emphasis has been given to population development, especially since 1998, with a focus on generating heterotic combinations for use in commercial cultivars by both NARS and private sector breeders.

**Recommendation 6**

The Panel **recommends** that the Maize Program increase the flow of information and germplasm between maize researchers in Regional projects and at headquarters by convening an annual meeting that includes maize scientists involved in germplasm improvement.

## Response

CIMMYT's new project structure ensures that there are better working links between regional-based and Mexico-based maize researchers. For example leadership of Global Project 4, concerned with increasing maize productivity and sustainability in stressed environments resides in Zimbabwe, with a large number of headquarters staff included in the project team.

In addition, we plan to conduct an annual meeting of all CIMMYT researchers at headquarters - the first of these meetings is scheduled for November 1998. We also anticipate that a program wide database of genotype-specific data will be established, allowing more timely and efficient exchanges of information between locations.

## Action since 1998

This recommendation has been implemented with program meetings involving HQ and regional staff convened during CIMMYT's annual project reporting week together with the development of a single announcement of all new CIMMYT materials regardless of where they have been developed. There is also one system of pedigree management 'FieldBk' that allows easier sharing of information. A further initiative involves the development of the MaizeFinder system which contains germplasm information in Dbase which is then linked to MaizeDB. MaizeFinder will be developed into a PC-

based system and it was noted that this will make the system particularly attractive for NARS and other partners as materials may be ordered on the internet.

#### Panel observations

This Recommendation has been partially implemented. The interaction between maize researchers at headquarters and outreach (partners and CIMMYT staff) has improved. This Recommendation can be achieved in a short time if greater emphasis is given to the improvement of data management.

#### *Recommendation 7*

The Panel **recommends** that the Maize Program fully incorporate marker-assisted breeding approaches into the mainstream maize breeding effort, which will require clarification of the roles and responsibilities of the Maize Program and the Applied Biotechnology Center.

#### Response

CIMMYT's maize program is committed to using the new plant breeding tools provided by biotechnology using two guiding principles:

- a) **CIMMYT will test new techniques in a practical maize breeding program as they become available; we need to be in the position of providing responsible advice on their use to NARS.**
- b) **The choice of crop improvement techniques will always take into account the cost effectiveness of a technique.**

One of CIMMYT's new MTP projects, Frontier Project 6, will undertake an analysis of the cost effectiveness of marker assisted breeding and genetic engineering vs. conventional approaches.

#### Action since 1998

There has been progress with the use of molecular markers, especially the marker for QPM (opaque-2 gene); about 20,000 samples per year are now routinely analysed using this marker. Marker Assisted Selection (MAS) is also in use for Maize Streak Virus (MSV) in a collaborative project between the Maize and Applied Biotechnology Programs; MSV is not present in Mexico but is an important disease in Sub Saharan Africa. Markers are also being sought for Fusarium, post harvest weevils, borers, and drought. [There is also work with downy mildew resistance on chromosome 6, fingerprinting of inbred lines, heterotic patterns, markers in the IRMA project, insect resistance mapping in DGIS projects in Africa and, QPM].

#### Panel observations

It has not been possible to fully implement this Recommendation in the mainstream maize breeding program. At present the MAS system is operating maize only for QPM and MSV selection programs. It is expected that more intensive use will be made in the mainstream CIMMYT breeding program in the near future with the advent of the Generation CP. However due to the complexity of the major traits of importance in maize in marginal environments MAS technology as it stands has its limits.

Meanwhile the genetic gains made in the maize improvement programs at CIMMYT has reached an outstanding level. Turning these results into improved cultivars that enhance production in resource poor farmers fields would seem to be a higher priority than prematurely applying MAS to the mainstream breeding efforts of CIMMYT.

#### *Recommendation 8*

The Panel **recommends** that the Maize Program thoroughly investigate the reason for lack of adoption of improved maize OPVs and hybrids on more than 40% of the maize area in developing countries.

## Response

CIMMYT accepts the challenge to identify factors affecting the degree of adoption of improved maize although the substantiation of this recommendation is not clear to us. We expect to develop further and teach participatory maize breeding methodologies to meet specific community needs in areas where there has been a major investment in maize breeding yet adoption rates are much lower than expected.

A study of factors affecting adoption rates is timely and it is anticipated that such a study may result in region specific breeding strategies and products and in a better definition of the comparative advantage of the Maize Program vis-à-vis the private sector.

## Action since 1998

This issue was highlighted in the 2002 “Maize Facts and Trends”. Some of the issues include: increased on-farm research; and, a lack of seed production programs for OPVs. Technology transfer programs have been intensified since 1998, particularly with the introduction of “Mother-baby” trials in Eastern Africa (1600 sites) and Southern Africa (1500 sites) in 2002 alone. CIMMYT has also commenced a number of new initiatives for seed production and distribution including a Rockefeller Foundation funded project in Kenya and Uganda and USAID funded efforts in the nine (9) SADC countries.

## Panel observations

The area referred to in the Recommendation includes the more difficult production environments. There is now both better germplasm available for the production of cultivars targeted specifically at these environments as well as a better understanding of the factors restricting uptake in the past. Progress in moving improved cultivars into marginal production environments in maize is still slow. Yet if CIMMYT is to achieve its new goal of reducing poverty and improving livelihoods, this is precisely the environments where more rapid progress needs to be made. This Recommendation has been partially accomplished.

**Recommendation 9**

The Panel **recommends** that the Applied Biotechnology Center, in collaboration with the Wheat and Maize programs, develop clear joint research plans with agreed priorities and focus for wheat and maize biotechnology and genetic engineering. Particular emphasis should be given to how these technologies will be incorporated into the CIMMYT wheat and maize breeding activities.

## Response

CIMMYT agrees with the recommended joint priority setting process. See also our comments on recommendations 3 and 7.

## Action since 1998

During CIMMYT’s annual Project Week, there is discussion of the role of biotechnology in the relevant global projects. CIMMYT has also established a new service laboratory- staffed with 50% of an IRS scientist and 6 technicians- to provide marker services and fingerprinting for genetic diversity studies.

## Panel observations

This Recommendation has only been partially met. The issue has been whether CIMMYT biotechnology should undertake cutting edge research in its own right and if so, how will it impact on poverty or provide services to other programs. The bias to date has been the former. As a result the support for marker screening is still below what is needed by the breeding programs and the CCER of CIMMYT’s Wheat Breeding Activities recommended they should be strengthened. The level of

interaction between the maize breeders and the Applied Biotechnology Program (ABP) was probably less effective than that between the wheat breeders and the ABP

***Recommendation 10***

The Panel **recommends** that the Natural Resources Group make conservation tillage and related soil and crop management practices the primary research focus of the NRG, with the goal of quantifying the effects of conservation tillage on water and nutrient use efficiency, soil quality, and productivity of maize and wheat based systems.

Response

CIMMYT endorses this focus and notes that the conservation tillage and residue management themes are already central to its work in Natural Resources. They are the key elements of Frontier Project 7 which is concerned with resource degradation issues in maize and wheat systems.

Action since 1998

This recommendation has been addressed, particularly in South Asia (resource conserving technologies in rice-wheat cropping systems), and in Southern Africa (soil fertility and maize-based cropping systems). It is also noted that one of CIMMYT's original MTP frontier projects (F7: Learning to more effectively confront problems of resource degradation in maize and wheat systems) had become a global project (G9: Conservation tillage and agricultural systems to mitigate poverty and climate change).

Panel observations

The Center has partially accomplished this Recommendation with the natural resources activities focusing on conservation tillage and related practices. However, quantifying the effect of conservation tillage on water and nutrient use efficiency, and soil quality needs further work in regional programs of CIMMYT. This may be achieved through collaboration with ARIs.

***Recommendation 11***

The Panel **recommends** that the Natural Resources Group establish a critical mass of scientific expertise in Frontier Project 7 to improve research efficiency and the complementation of strategic and applied research on conservation tillage systems.

Response

CIMMYT agrees to strengthen the input of Maize and Wheat Programs in Frontier Project 7. In addition, CIMMYT proposes to continue with the innovative use of consultants, associates and collaborative projects in pursuing priority themes within this project.

Action since 1998

Due to the relatively small size of the Natural Resources Group, almost all activities involve collaboration with the Maize and Wheat (and Economics) Programs.

Panel observations

The Center has accomplished the Recommendation by increasing collaboration between the former NRM, Maize and Wheat Programs, and recently through the integration of NRM with the commodity research within the ecoregional programs.

***Recommendation 12***

The Panel **recommends** that the Economics Program determine, in discussions with the RCC, the balance of its research activities in institution-wide activities, support to other programs, support to NARS, and its own frontier research.

## Response

CIMMYT agrees that there should be a balance of activities under these headings however we also maintain that, under the new MTP project structure, the role of the Economics program and the input it makes is appropriate and balanced and has been determined following extensive consultation with partners, including NARS.

## Action since 1998

CIMMYT agrees that this recommendation requires further discussion; quantifying the current balance of activities in the program would be a most useful exercise.

## Panel observations

The former Economics Program did not address this and nor has it yet been addressed by the current Social Science Group or within the ITA Program. The Recommendation remains valid.

***Recommendation 13***

The Panel **recommends** that the Economics Program strengthen its presence in the Asian region through a greater use of affiliate economists working in close collaboration with NARS and ARIs.

## Response

CIMMYT agrees and we are taking steps to increase our presence in the region through special project funding. We have developed proposals for a strengthened presence in the Asian region following a similar recommendation made during the Center Commissioned External Review of the CIMMYT Economics Program, conducted in June 1997.

## Action since 1998

The Economics Program withdrew from the Bangkok office in the mid 1990's however, since then there have been concerted efforts to raise special project funding for activities in Asia. For example, an IFAD funded project involving 7 countries employs a regional economist (R. Gerpacio) based at IRRI in the Philippines. There are also efforts underway to enhance economics activities in the Rice-Wheat Consortium (RWC).

## Panel observations

CIMMYT does not seem to have effectively addressed this Recommendation.

***Recommendation 14***

The Panel **recommends** that the Economics Program, in view of the increasing importance of macroeconomic policies as they affect maize and wheat, gradually place more emphasis on this aspect of research focusing on a few selected countries.

## Response

CIMMYT agrees and has commenced the development of proposals to examine macro policy issues in key maize and wheat countries including those in the Asian region.

## Action since 1998

10-15 years ago there was an emphasis on this type of work however, demand has declined and the demand for technology evaluation and dissemination studies has increased. More recently, we note that the strategic planning discussions have identified policy advocacy as an important component of CIMMYT's work; this will require policy work although may overlap with the work of IFPRI. In recent years we have been doing macro policy work in Central America (SDC funding) with a key output being a series of policy briefs.

## Panel observations

Evidence was not available of additional work done in macroeconomic policies. It looks like the emphasis has moved in the opposite direction (case studies).

**Recommendation 15**

The Panel **recommends** that CIMMYT management establish a regular annual review of issues of common interest between INIFAP and CIMMYT, with each organization represented by a small group of senior administrative and research officers.

## Response

CIMMYT agrees and conducted a series of meetings during December 1997 and plans to follow up on key issues on a regular basis.

## Action since 1998

There has been ongoing dialogue between INIFAP and CIMMYT, especially on the subject of QPM (maize) and in the area of wheat research at the Ciano field station, where INIFAP provides considerable support to CIMMYT activities including the time of key researchers.

## Panel observations

No formal record of annual review has been provided to the EPMR Panel. But CIMMYT Management states that there has been ongoing dialogue on QPM. The formal annual review recommended by the 4th EPMR should be established.

**Recommendation 16**

The Panel **recommends** that CIMMYT management prepare all future budget proposals on the basis of full project costing, showing both income and expenditure for all project outputs"

## Response

CIMMYT's Board and Management agree with the need for full-project costing within CIMMYT and, indeed, within all other units of the CGIAR. Some of what needs to be done on full-costing can be done within CIMMYT itself; however, to be truly effective, such efforts will also need to be supported-intellectually and financially-by donors to the various projects.

In CIMMYT's view, a commitment to full-cost accounting is far from trivial. Such a commitment embraces six distinct components, not all of which are under CIMMYT's direct control. It will be necessary: 1) for CIMMYT's auditors to work with CIMMYT management (as they are now doing) to verify the scope and quantitative estimates of costs components in the indirect cost rate(s); 2) for CIMMYT to plan for flexibility in project preparation to accommodate various donor rules for including legitimate costs in proposals. Some donors, for example, will not permit a line entitled 'indirect costs' as a specified percentage, but will allow a line or lines showing direct charges for elements (such as space charges) that might typically be included in indirect charges; 3) for the Board policy (which CIMMYT now has) to embrace full cost recovery as the goal of the Center (yet knowing that in some instances that such recovery will not be forthcoming), thereby shifting the burden of proof and argument to those projects that do not cover full costs; 4) for the Board and Senior Management to use indirect cost recovery as one component in judging performance of managers; 5) for all Centers in the CG System to move toward recovery of full-costs to prevent 'cost cutting' on indirect costs from becoming a destructive element of competition among Centers; and 6) for donors to face up to the legitimate nature of indirect costs in their funding of projects and understand that it is basically self-destructive for a Center to use unrestricted funds to cover the indirect costs of special projects. CIMMYT also notes that non-payment of indirect costs on projects leads to tensions and

suggestions of 'free-riding' within the donor community itself. CIMMYT's Board and Management believe that implementation of the principle of full-costs pricing, especially for special projects, is critical for the entire CG System and hope that a discussion of this principle will be an element of the System Review now in progress.

#### Action since 1998

CIMMYT has endeavoured to develop a better costing system for projects however this is still a work in progress. Renewed efforts will be made, commencing 2005, to ensure that all projects are properly costed and that, where possible, staff currently on unrestricted funding will be transferred across to project funding where there is programmatic alignment. The CGIAR Internal Audit Unit under John Fitzsimon has been helpful in developing Good Practice Notes on Project Costing and in undertaking an audit of CIMMYT's projects costing.

#### Panel observations

Little progress has been made by CIMMYT and a formal full project costing system is not available yet. However, the new Director for Corporate Services has this issue high on the agenda.

#### *Recommendation 17*

The Panel **recommends** that CIMMYT management take all the necessary steps and obtain the necessary expert input to develop and implement an integrated strategy for information technology and the operation of CIMMYT's management information systems.

#### Response

CIMMYT agrees and notes that its Board of Trustees has approved a major review and consultancy of CIMMYT's information technology requirements. A consultants report is expected by late-1998.

#### Action since 1998

A review was conducted by the University of Georgia and several recommendations were acted upon. In 2001, a mini-symposium was organized to coincide with a CIMMYT Board meeting to raise the level of awareness of the need for CIMMYT to address IT issues. CIMMYT has worked on a number of projects with the National Center for Genome Resources in Santa Fe. During this time the role of the IT manager has been redefined and there has been staff turnover. More recently, CIMMYT has appointed a short-term specialist, Jens Riis-Jacobsen, to work on projects associated with systemwide initiatives in the areas of genebank upgrading and ICT/KM. A bioinformatics specialist (Guy Davenport) has recently been appointed, in part to help CIMMYT fulfil commitments under the Generation CP but, also, as a longer term measure to increase capacity in this area.

#### Panel observations

Little or no progress had been made on developing an integrated strategy for information technology and the operation of CIMMYT's management information systems. This Recommendation is still pertinent today.

#### *Recommendation 18*

The Panel **recommends** that CIMMYT management implement a policy of full charging for all samples processed by the various laboratory services and evaluate the relative cost effectiveness and analytical quality of outsourcing the supply of the different types of laboratory analysis.

#### Response

CIMMYT management has commissioned a review of the soil and plant analytical facility and a Users Group has been established to help set policy that will include consideration of charge back systems and provision for equipment upgrading.

*Action since 1998*

The soils and plant laboratory has been operating successfully in recent years under a system of charge-backs. During this period, the turnaround time for analysis of samples has decreased markedly and there has been better prioritization of samples for analysis by CIMMYT researchers.

*Panel observations*

The charge back system is in place but part of the recoveries are not being used for upgrading the lab equipment as indicated in management response to the Recommendation.

***Recommendation 19***

The Panel **recommends** that the CIMMYT Board ensure that adequate information on the budget and important policy decisions is provided to all Board members irrespective of the specific committee on which they serve; and that the flow of information from committees and Board be improved.

*Response*

The CIMMYT Board concurs completely with this recommendation. Henceforth, all Board members will receive materials for each of the Board Committees, whether or not they are members of a particular committee. Procedural changes were made in 1997 to ensure that all Board members are sent quarterly financial statements and audit reports. The financial reports themselves have been amplified and redesigned, and arrangements have also been made for a specific Trustee on each committee to take lead responsibility for assessing CIMMYT's financial health (currently A. Gregson for the Audit Committee, J. Holmberg for the Program Committee, and W. Falcon for the Executive and Finance Committee).

*Action since 1998*

All trustees now receive all papers for the Board meetings, irrespective of their committee assignments. More recently, the CIMMYT Board has chosen to conduct committee meetings sequentially rather than concurrently.

*Panel observations*

The intention with Board meetings is to send all materials, including committee materials, two weeks in advance of the meeting. Board members are provided with compensation for a reading day in order to encourage thorough preparation. However, new materials are still distributed at the meetings, making thoughtful preparation and discussion a challenge.

A more serious information gap exists in the interval between meetings, particularly with respect to financial information and significant program and personnel events that touch on the Board's oversight responsibilities. This lapse is particularly acute with respect to communications with the chairs of the Finance and Administration and Audit committees.

***Recommendation 20***

The Panel **recommends** that the CIMMYT Board commission an external review (CCER) to be conducted by mid-2000 to assess progress in implementing the project based approach to research management as outlined in the MTP. This review should include the assessment of progress towards the attainment of management systems to support these projects, integration of financial and human resource databases, the implementation of a strategy on information technology, and the operation of CIMMYT's management information systems.

Response

The CIMMYT Board concurs with this recommendation and commits itself to an externally commissioned review (CCER) to assess implementation of the project-management approach outlined in the MTP. The Board understands that the 1997 EPMP occurred at a time of transition for the organizational structure within CIMMYT and believes that a serious review of the new approach is appropriate in two years. The current thinking of Board and Management is to name external reviewers in the autumn of 1999 (perhaps during Center's Week) and to complete the review before September 2000.

Action since 1998

The review, led by Ken Cassman, was carried out. A full report on the review and management's response is tabled as part of the background reading for the 5th EPMP.

Panel observations

No progress has been made on the project management system in response to the 4th EPMP and the subsequent CCER recommendations. The 5th EPMP Panel **suggests** that CIMMYT gives high priority to this activity to support its matrix management systems also.

## RE-THINKING GOVERNANCE IN CGIAR CENTERS

Effective, diligent governance of the Centers that comprise the CGIAR has always been a concern of the System. In part, this is a function of each Board's legal responsibility to safeguard the public interest at the heart of a Center's mission and purpose, and to assure beneficiaries, donors and others that the assets and resources of the organization are used effectively to achieve a public good. It is also a function of the Centers' acute awareness of their collective responsibility to address urgent and fundamental human needs that makes anything less than effective, diligent governance unacceptable.

Good governance tends to be valued most highly when its absence has contributed to organizational calamity. This was true in the early 1990s when high profile failures within the non-profit sector brought home the consequences of board negligence, and is equally true today with problems in the corporate sector that have prompted widespread reforms affecting both for-profit and not-for-profit boards.

In the absence of calamity as a spur to reform, there are still compelling reasons to re-think what Boards do. Boards do not work in a vacuum; as organizations change, Boards should consider whether the expectations and practices that once defined good governance still work to achieve that goal or whether different approaches are required.

CIMMYT's 5th EPMR, like other recent Center reviews (IRRI is a good example), highlighted the System's heightened attention to Center governance as well as particular concerns with the performance of CIMMYT's Board in recent years. The review also revealed an awkward fit between the accepted standards within the System for evaluating the governance function and the demands that CIMMYT's growing organizational complexity places on its Board.

Panel members believed this last issue was not unique to CIMMYT, and to encourage a broader consideration of whether and how Center governance might evolve, the Panel includes a more general discussion of the issue in this appendix.

### Changing the nature, focus and structure of Center governance

In 1997, the CGIAR published a series of booklets renewing the case for good governance and providing Centers with detailed information on Board structure and practice. The eight booklets described a Center Board's basic roles and responsibilities, and outlined the essential elements of Board structure and practice that would help ensure Board effectiveness. The template that emerged both affirmed good practices already in place within many of the Centers and provided a highly serviceable framework for undertaking improvements.

Many of the recommended practices continue to be of value, but it is the Panel's view that the overall framework fails to emphasize critical requirements for contemporary governance or to yield a Board that is nimble and highly adaptive in its work. Rather than provide an itemized critique of current practice, the Panel prefers to raise issues that seem essential for effective Center governance going forward.

### Re-defining the Board's role

Centers are large and financially complex enterprises, with far flung operations, facing stiff competition for resources and frequently working in areas parallel and sometimes identical to the corporate sector. It is more common for Centers to find themselves in trouble because of

mismanagement—financial or otherwise—than because the research agenda or the quality of scientific work is flawed. The nature of the enterprise combined with the frequent nature of the problems argue for a Board that brings much more focus, commitment and ability to financial and management issues; one that accepts this as its primary role and obligation, and that organizes itself to be effective in that dimension of its work. In addition, it is more efficient to emphasize this role and recruit for expertise in it than to attempt to create this capacity after the fact with Board members who see both their skills and interests as being elsewhere.

To the Panel, this seems like a logical and necessary shift in the way Center Boards define their role and build their capacity. It is no longer functional and may be counterproductive to make oversight of science and research a primary role or responsibility of the Board. While this is a responsibility that cannot be wholly relinquished by the Board, it can be managed more efficiently in other ways, for example, through CCERs, a higher level of Board engagement in the results of the EPMRs, and the use of task-specific scientific advisory groups, rather than through building a Board with a depth and breadth of research-related expertise that mimics staff capacity and duplicates checks and balances available elsewhere, including the CGIAR system, the professional culture of the sciences, and the competitive market for resources.

In the new formulation of the Board's role, there would be:

- a) An emphasis on
  - oversight and stewardship responsibilities for Center financial operations, the prudent use of resources, financial stability, and financial sustainability
  - evaluation and decision making that are strategic—well informed and forward looking
  - a relationship with the DG that is collegial but rigorous
  - a capacity to build resources and forge new relationships
  
- b) A de-emphasis on
  - stakeholder representation as a role for board
  - direct board oversight of the research agenda, scientific outputs, and the quality of science

Smaller Boards, more strategic composition and leaner structures

The current formulation for Board composition places a value on highly representative Boards, and Boards that bring a broad array of skills and perspectives to the table. This creates Boards that are large, difficult to keep engaged and informed, and expensive to convene for meetings and other activities.

If the Board's role is more narrowly defined, a small Board can still comprise critical expertise and representation if the priorities are clear and the recruitment process for new Board members is rigorous. Small Boards tend to be more active, with higher levels of engagement as a group but also individually. Because each absence or failure to perform is more noticeable in a small Board, small Boards build internal accountability that contributes to productivity.

A small Board also requires a rethinking of the committee structure. Current practice usually results in a standing committee structure that is uninflected in terms of the value to the Board or the Center of small group versus full group work, and reinforces the need for a Board of a certain size. A small Board requires a more functional committee structure—fewer standing committees, smaller committees that provide value to the full Board and greater use of ad hoc committees or task forces with focused assignments and short life spans.

How small is small:

- 7-10 elected members (to include no more than one CGIAR-endorsed member)
- as few ex officio members as possible

What should drive the recruitment of members:

- Priority on expertise and influence driven by assessments of needs/capacity
- Gender balanced
- Strategic regional balance

What is the leanest possible committee structure:

Strategic executive committee (meets only when necessary or to complete tasks assigned by Board)

Limited number of standing committees: Governance/Nominating, Audit, Finance/Administration;

An increased use of task forces with a focused assignment

More frequent, shorter Board meetings and more strategic, focused agendas

CIMMYT provided a telling example of the challenges a Board faces when it meets only twice a year. Infrequent meetings make it difficult to build continuity, track changes in a Center's performance, and make decisions that feel timely or relevant. It is hard to build a sense of urgency around problems or opportunities. The lack of time spent on the affairs of the organization can erode the confidence and moral authority of the Board to engage and challenge management and hold it accountable.

To be effective, Boards need to meet more often (using meetings of the executive committee judiciously when they can't), for shorter periods and with more highly focused agendas. Field trips and site visits need to be carefully weighed to determine their value in building Board knowledge and commitment against the extended time commitments and inefficiencies they entail. A small Board can bring the cost of meetings down, as can shorter meetings. If Center meetings were shorter and more crisply organized, Board service might be more appealing and more possible for those in the private sector who cannot sacrifice four to five days at a time to a volunteer activity, no matter how worthwhile.

Oversight of Science

Center Boards have traditionally had a significant number, often a majority, of members who were active scientists or science managers with experience in areas of relevance to the Center's major research activities. These members have provided a strong capacity for Board oversight of the Center's science usually through a Program Committee.

A reduction in the number of Board members with experience in science and the abolishment of the traditional program committee may raise concerns about science oversight amongst some members of the CGIAR. One solution to these concerns would be the appointment of a Scientific Advisory Committee (SAC) of say, 4-6 members, which could advise the Center and Board on the quality of its science. The SAC could meet yearly, for example at the time of the annual work planning and priority setting meeting of the Center, and report formally either to the Management or Board. Under this arrangement the SAC members could focus their expertise on monitoring quality of science in the Center as well as input expert external advice into the planning process.

## BRIEF ON ISO 9001:2000 CERTIFICATION

ISO 9001:2000 Certification requires adherence to ISO internationally recognized standards. Organizations are subjected to special international audit to acquire certification. Maintaining ISO certification requires annual specialized audit. The information below provides the benefits and principles of ISO certification.

What are ISO standards?

Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose.

International Standards thus contribute to making life simpler, and to increasing the reliability and effectiveness of the services we use.

Quality management principles

The following text is an integral reproduction of the content of the document "Quality Management Principles".

### *Introduction*

This document introduces the eight quality management principles on which the quality management system standards of the revised ISO 9001:2000 series are based. These principles can be used by senior management as a framework to guide their organizations towards improved performance. The principles are derived from the collective experience and knowledge of the international experts who participate in ISO Technical Committee which is responsible for developing and maintaining the ISO 9000 standards.

The eight quality management principles are defined in ISO 9000:2000, *Quality management systems Fundamentals and vocabulary*, and in ISO 9004:2000, *Quality management systems Guidelines for performance improvements*.

This document gives the standardized descriptions of the principles as they appear in ISO 9000:2000 and ISO 9004:2000. In addition, it provides examples of the benefits derived from their use and of actions that managers typically take in applying the principles to

#### Principle 1: Client focus

Organizations depend on their clients and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

Key benefits:

- Increased revenue and market share obtained through flexible and fast responses to market opportunities.
- Increased effectiveness in the use of the organization's resources to enhance customer satisfaction.
- Improved customer loyalty leading to repeat business.
- Applying the principle of customer focus typically leads to:

- Researching and understanding customer needs and expectations.
- Ensuring that the objectives of the organization are linked to customer needs and expectations.
- Communicating customer needs and expectations throughout the organization.
- Measuring customer satisfaction and acting on the results.
- Systematically managing customer relationships.
- Ensuring a balanced approach between satisfying customers and other interested parties (such as owners, employees, suppliers, financiers, local communities and society as a whole).

### Principle 2: Leadership

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

#### Key benefits:

- People will understand and be motivated towards the organization's goals and objectives.
- Activities are evaluated, aligned and implemented in a unified way.
- Miscommunication between levels of an organization will be minimized.
- Applying the principle of leadership typically leads to:
- Considering the needs of all interested parties including customers, owners, employees, suppliers, financiers, local communities and society as a whole.
- Establishing a clear vision of the organization's future.
- Setting challenging goals and targets.
- Creating and sustaining shared values, fairness and ethical role models at all levels of the organization.
- Establishing trust and eliminating fear.
- Providing people with the required resources, training and freedom to act with responsibility and accountability.
- Inspiring, encouraging and recognizing people's contributions.

### Principle 3: Involvement of people

People at all levels are the heart of an organization and their full involvement enables their abilities to be used for the organization's benefit.

#### Key benefits:

- Motivated, committed and involved people within the organization.
- Innovation and creativity in furthering the organization's objectives.
- People being accountable for their own performance.
- People eager to participate in and contribute to continual improvement.
- Applying the principle of involvement of people typically leads to:
- People understanding the importance of their contribution and role in the organization.
- People identifying constraints to their performance.
- People accepting ownership of problems and their responsibility for solving them.
- People evaluating their performance against their personal goals and objectives.
- People actively seeking opportunities to enhance their competence, knowledge and experience.
- People freely sharing knowledge and experience.
- People openly discussing problems and issues.

#### Principle 4: Process approach

A desired result is achieved more efficiently when activities and related resources are managed as a process.

##### Key benefits:

- Lower costs and shorter cycle times through effective use of resources.
- Improved, consistent and predictable results.
- Focused and prioritized improvement opportunities.
- Applying the principle of process approach typically leads to:
- Systematically defining the activities necessary to obtain a desired result.
- Establishing clear responsibility and accountability for managing key activities.
- Analysing and measuring of the capability of key activities.
- Identifying the interfaces of key activities within and between the functions of the organization.
- Focusing on the factors such as resources, methods, and materials that will improve key activities of the organization.
- Evaluating risks, consequences and impacts of activities on customers, suppliers and other interested parties.

#### Principle 5: System approach to management

Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

##### Key benefits:

- Integration and alignment of the processes that will best achieve the desired results.
- Ability to focus effort on the key processes.
- Providing confidence to interested parties as to the consistency, effectiveness and efficiency of the organization.
- Applying the principle of system approach to management typically leads to:
- Structuring a system to achieve the organization's objectives in the most effective and efficient way.
- Understanding the interdependencies between the processes of the system.
- Structured approaches that harmonize and integrate processes.
- Providing a better understanding of the roles and responsibilities necessary for achieving common objectives and thereby reducing cross-functional barriers.
- Understanding organizational capabilities and establishing resource constraints prior to action.
- Targeting and defining how specific activities within a system should operate.
- Continually improving the system through measurement and evaluation.

#### Principle 6: Continual improvement

Continual improvement of the organization's overall performance should be a permanent objective of the organization.

##### Key benefits:

- Performance advantage through improved organizational capabilities.
- Alignment of improvement activities at all levels to an organization's strategic intent.

- Flexibility to react quickly to opportunities.
- Applying the principle of continual improvement typically leads to:
- Employing a consistent organization-wide approach to continual improvement of the organization's performance.
- Providing people with training in the methods and tools of continual improvement.
- Making continual improvement of products, processes and systems an objective for every individual in the organization.
- Establishing goals to guide, and measures to track, continual improvement.
- Recognizing and acknowledging improvements.

#### Principle 7: Factual approach to decision making

Effective decisions are based on the analysis of data and information

Key benefits:

- Informed decisions.
- An increased ability to demonstrate the effectiveness of past decisions through reference to factual records.
- Increased ability to review, challenge and change opinions and decisions.
- Applying the principle of factual approach to decision making typically leads to:
- Ensuring that data and information are sufficiently accurate and reliable.
- Making data accessible to those who need it.
- Analyzing data and information using valid methods.
- Making decisions and taking action based on factual analysis, balanced with experience and intuition.

#### Principle 8: Mutually beneficial relationships with Clients

An organization and its clients are interdependent and a mutually beneficial and healthy relationship enhances the ability of both to create value to the organization

Key benefits:

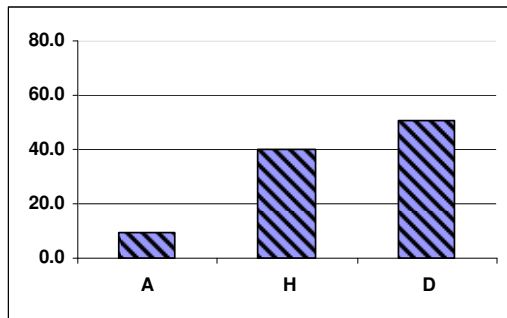
- Increased ability to create value to the organization
- Flexibility and speed of joint responses to changing needs and expectations.
- Optimization of costs and resources.
- Applying the principles of mutually beneficial and healthy client relationships typically leads to:
- Establishing healthy relationships that balance short-term benefits with long-term considerations.
- Pooling of expertise and resources with clients and partners.
- Clear and open communication.
- Sharing information and future plans.
- Establishing joint development and improvement activities.
- Inspiring, encouraging and recognizing improvements and achievements by clients.

**RESULTS OF THE CIMMYT STAFF SURVEY**

CIMMYT staff were asked to respond to statements on 12 themes by choosing one of three options: Agree (A), Hard to Decide (H; neither agree nor disagree) or Disagree (D). The proportion of different responses to each statement is shown in the graphs below. The number of respondents (75 in total) is given in brackets.

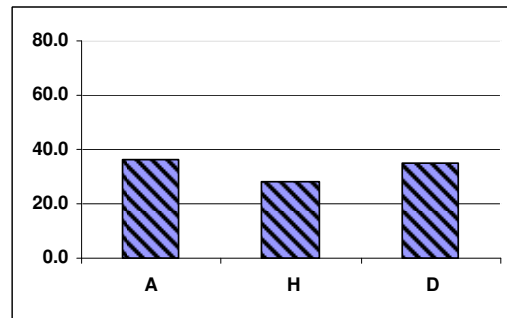
**1. CIMMYT Culture**

Decision-making is highly participative and I feel free to express my opinion on work related issues. (75)



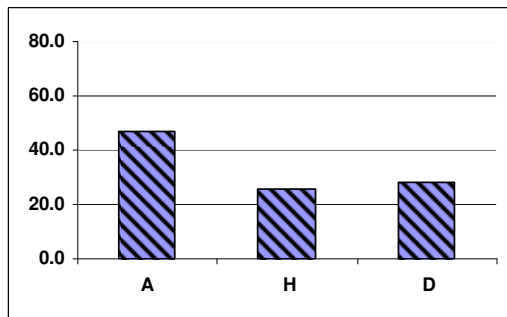
**4a. Internal Communication Processes**

a. Generally, I am provided the information I need to do my job in the best possible way. (74)

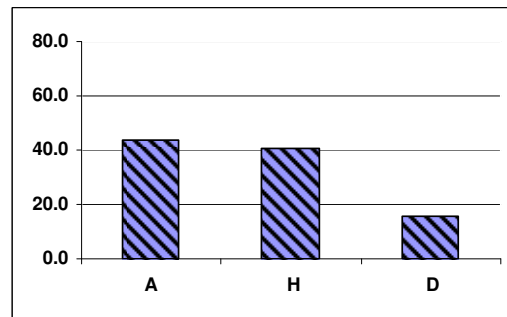


**2. Goals, Mission and Direction**

The goals, mission and direction of CIMMYT are clearly communicated to staff. (75)

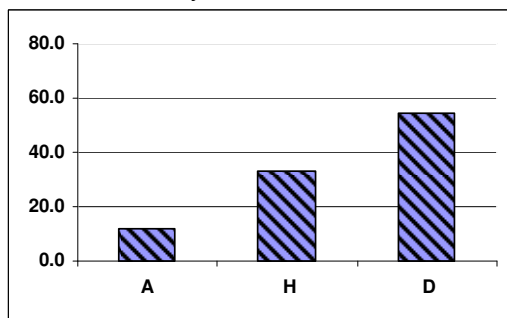


b. The written communications I receive at CIMMYT are clear and understandable. (71)



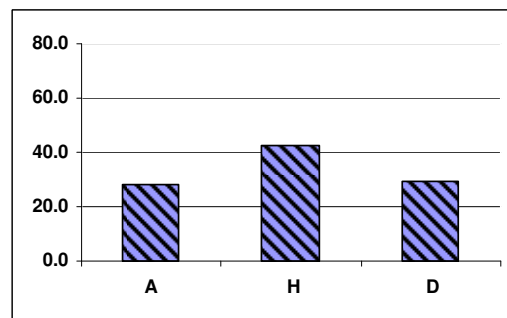
**3. Policies and Procedures**

The manner in which new and revised procedures and policies are communicated to staff is satisfactory. (75)



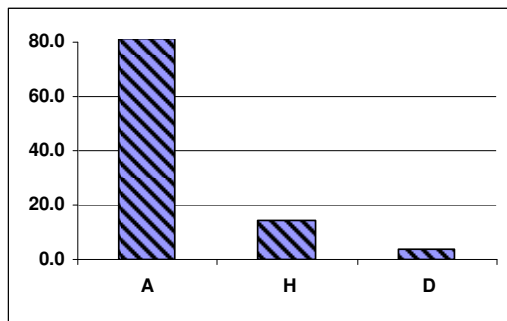
**5. Working Conditions**

CIMMYT is willing to invest in equipment and provide facilities needed to ensure high quality results. (75)



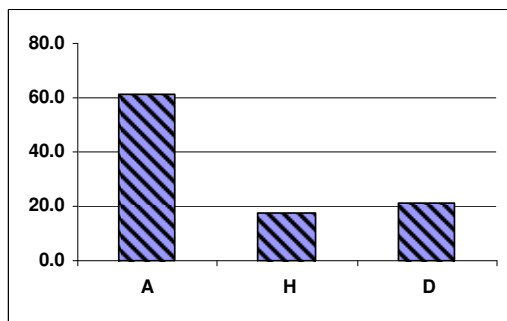
6. Job Definition

My skills, abilities and professional experience fully match with the requirements of my position. (75)



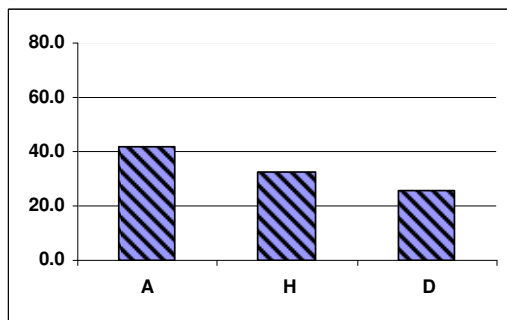
7. Job Satisfaction

My position gives me the opportunity to develop my individual talents. (75)



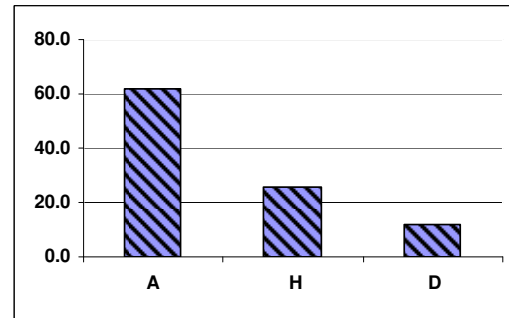
8. Leadership

My immediate supervisor communicates specific work goals to me clearly (74)



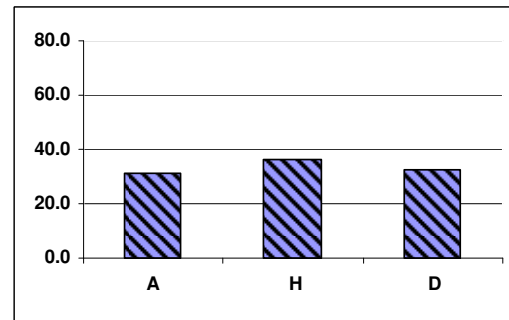
9. Co-Worker Relations

The people I work with daily have a high level of trust and confidence in each other. (74)

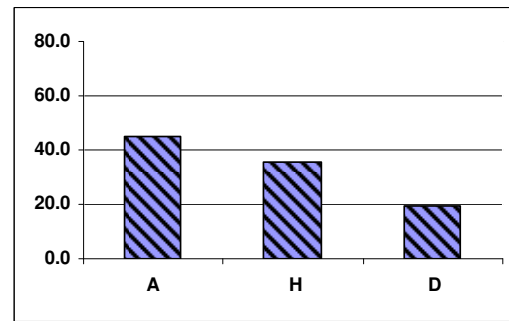


10. Staff Empowerment

a. The recognition I receive from CIMMYT when I solve a work-related problem motivates me to work harder. (74)

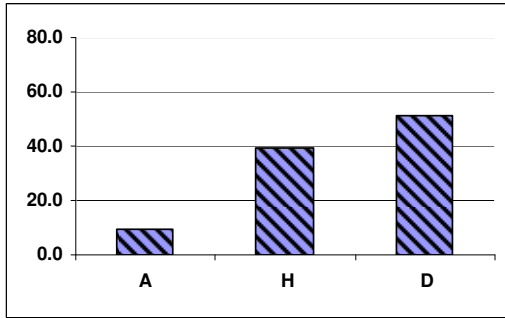


b. I can express my opinion in issues that affect my work. (73)



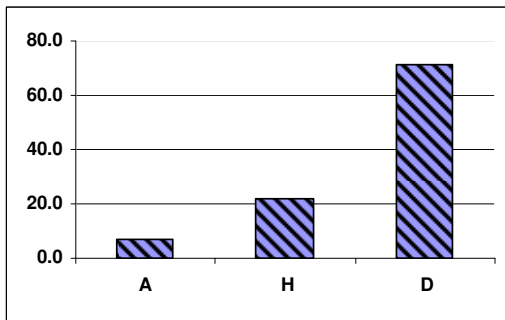
11. Staff Performance Evaluation

The last staff evaluation has helped me to improve my job performance. (74)

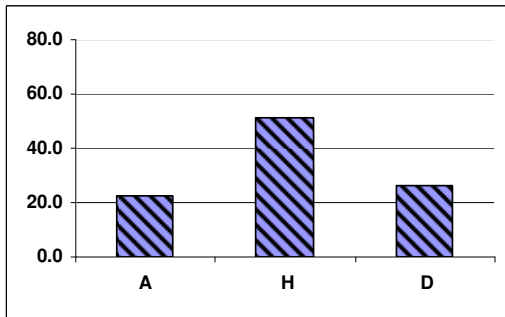


12. Identity with CIMMYT

a. The morale of staff at CIMMYT is high. (73)



b. I would recommend CIMMYT to my friends as a good place to work. (72)



## LIST OF ACRONYMS

ABC	Applied Biotechnology Center
ALP	African Livelihoods Program
AMBIONET	Asian Maize Biotechnology Network
AMS	Africa Maize Stress
APSIM	Agricultural Production Systems Simulator Model
ARI	Advanced Research Institute
BCA	Bangladesh Country Almanac
CCER	Center-Commissioned External Review
CDC	Center Directors Committee
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CNRM	Crop and Natural Resources Management
CP	Challenge Program
CWANA	Central West Asia-North Africa Region
DDG-R	Deputy Director General Research
DG	Director General
DNA	Deoxyribonucleic acid
DREB	Evaluation of Transcriptional Factor Genes
DSSAT	Decision Support System for Agrotechnology Transfer
ECAMAW	Eastern and Central Africa Maize and Wheat Network
EPMR	External Program and Management Review
ExCo	Executive Council
FAO	Food and Agriculture Organization of the United Nations
FTE	Full Time Equivalents
GIS	Geographic Information Systems
GMO	Genetically Modified Organism
GQL	Grain Quality Laboratory
GRP	Genetic Resources Program
HQ	Headquarters
HR-SAS	Human Resources – Strategic Advisory Services
IAP	Intensive Agro-Ecosystem Program
IAS	Intensive Agro-Ecosystems
ICARDA	International Center for Agricultural Research in the Dry Areas
ICIS	International Crop Information System
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IGP	Indo-Gangetic Plains
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IMTU	International Maize Testing Unit
IPR	Intellectual Property Rights
IRMA	Insect Resistant Maize for Africa
IRRI	International Rice Research Institute
IRS	Internationally Recruited Staff
ISO	International Organization for Standardization
IT	Information Technology

ITA	Impact Targeting and Assessment
IWIN	International Wheat Improvement Network
IWIS	International Wheat Information System
IWWIP	International Winter Wheat Improvement Program
KARI	Kenya Agricultural Research Institute
LDC	Lesser Developed Countries
MAS	Marker Assisted Selection
MMPA	Marginal Maize Production Areas
MPBCRC	Molecular Plant Breeding Cooperative Research Center
MTP	Medium-Term Plan
MV	Modern Varieties
NARI	National Agricultural Research Institute
NARS	National Agricultural Research System
NGO	Non-Governmental Organizations
NIR	Near Infrared Spectroscopy
NRG	Natural Resources Group
NRM	Natural Resource Management
NRS	Nationally Recruited Staff
OPV	Open Pollinated Varieties
PGRFA	Plant Genetic Resources for Food and Agriculture
PSC	Program Steering Committee
QPM	Quality Protein Maize
QTL	Quantitative Trait Loci
RAT	Resource Allocation Tool
RCT	Resource Conserving Technologies
REGNUR	East and Southern African Regional Maize Nursery Project
RFWS	Rainfed Wheat Systems
RWC	Rice-Wheat Consortium
SADC	Southern Africa Development Community
SADLF	Southern African Drought and Low Soil Fertility Project
SHU	Seed Health Unit
SIDU	Seed Inspection and Distribution Unit
SoilFertNet	Soil Fertility Management and Policy Network for Maize-Based Farming Systems in Southern Africa
SRO	Sub-Regional Organization
SSA	Sub-Saharan Africa
SSG	Social Sciences Group
TAC	Technical Advisory Committee
TES	Tropical Ecosystems
TRIPS	Trade-Related Aspects of Intellectual Property
UNDP	United Nations Development Program