

consultative group on international agricultural research
technical advisory committee and cgiar secretariat

report of the
fourth external programme and management review
of the international rice research institute
(IRRI)



This report comprises:

- (a) Extract from: "Summary of Proceedings and Decisions", CGIAR Mid-Term Meeting 1993, San Juan, Puerto Rico, 24-28 May 1993
- (b) Letter from TAC Chairman and CGIAR Executive Secretary, transmitting the Report of the Fourth External Programme and Management Review
- (c) TAC Commentary on the External Review of IRRI
- (d) IRRI's response to the Report of the Fourth External Programme and Management Review
- (e) Transmittal letter from Panel Chairman to TAC Chairman and CGIAR Executive Secretary
- (f) Report of the Fourth External Programme and Management Review of the International Rice Research Institute (IRRI)

**THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
TECHNICAL ADVISORY COMMITTEE AND CGIAR SECRETARIAT**

**REPORT OF THE
FOURTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW
OF THE
INTERNATIONAL RICE RESEARCH INSTITUTE
(IRRI)**

**TAC SECRETARIAT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
October 1993**

Consultative Group on International Agricultural Research

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From: The Secretariat

August 1993

CGIAR Mid-Term Meeting May 24-28, 1993 San Juan, Puerto Rico

Rice research in the CGIAR System 1/

Issues concerning rice research in the CGIAR system were examined in relation to the External Program and Management Reviews (EPMRs) of IRRI and WARDA, the two centers' MTPs, an intercenter rice review, and TAC's draft Strategy Statement on Rice Research.

The agenda was structured in such a way that members of the Group could comment on matters specific to the two centers as well as on broad strategic issues including intercenter responsibilities and resource allocations.

The EPMRs were introduced by the chairmen of the review panels - David Bell (IRRI) and Declan Walton (WARDA). The centers were represented by Board Chairs and Directors General - Walter Falcon and Klaus Lampe (IRRI); Henri Carsalade and Eugene Terry (WARDA). Grant Scobie, chairman of the panel, introduced the intercenter rice review.

Inaugurating discussion of the agenda item as part of a unified theme, the Chairman reminded the Group that consideration of individual center programs and plans could lead to the emergence of major issues that relate to rice research generally, to the niche of CGIAR centers in global rice research activities, and to continental rice research responsibilities. He suggested that the Group should consider center-specific discussions as entry points for consideration of broader issues.

Some major questions that he felt the CGIAR system should address were the need to double rice production in 30 years, the need for higher yields, concern about declining yields, and the need to balance productivity with sustainability.

1/ Extract from "Summary of Proceedings and Decisions", CGIAR Mid-Term Meeting 1993, San Juan, Puerto Rico

Setting the context for a consideration of rice research issues, TAC's draft strategy statement pointed out that rice is the most important food crop in the world and is the major staple for 2.7 billion people in Asia alone. Over 90 percent of the world's rice production is both produced and consumed in Asia. Global demand for rice is projected to grow at a rate at least equal to population growth rates and by the year 2030 the amount of rice needed will be more than double present output. Of the extra output of rice to be produced, 91.3 percent will be needed in Asia, 3.8 percent in Sub-Saharan Africa, 3.8 percent in Latin America, and 1.1 percent in West Asia/North Africa (WANA).

Currently, the TAC statement said, the CGIAR allocates 65.6 percent of core expenditures for rice improvement to Asia, 21.4 percent to Sub-Saharan Africa (17.1 percent to West Africa), 10.7 percent to Latin America and the Caribbean, and 2.3 percent to WANA.

TAC observed, as well, that there are four major themes in international rice research to which the CGIAR must make a major contribution:

- Raise the yield ceiling, which has not increased significantly since IR8 was released in 1966;
- Close the gaps between potential yields and those achieved in farmers' fields;
- Sustain current yields - sustainability issues in this connection include the problems of the less favorable rainfed environments as well as those of yield decline in irrigated systems; and
- Build or strengthen national research capacity.

In the course of the discussion, the chairmen of all three review panels emphasized the importance of rice research in the CGIAR system. Mr. Scobie said that research is an essential component of the increased productivity that will be required to meet the world's growing food requirements. Mr. Bell said that major strategic problems such as the yield ceiling and the decline in factor productivity were not likely to be overcome unless IRRI takes the lead in mobilizing scientific and financial resources to deal with them. Mr. Walton, who described rice as "a star crop" in West Africa - on account of the high rate at which the demand for rice is increasing - argued the need for a major rice research program in the region.

Mr. Bell presented a highly positive assessment of IRRI. The central finding of the review panel, he said, is that IRRI has emerged successfully from a period of change and is ready to settle down to a period of solid, productive work.

On the program side, he said, the review panel found the center to be well into a major transformation, with more emphasis on strategic research, more attention to less favorable rice growing environments, more concern with equity, sustainability, and resource management, all carried out without diverting the center's attention from germplasm improvement and production in more favorable environments.

In the area of management, he said, IRRI has made major changes in scientific organization, management systems, financial administration, and Board functions.

Under a new organizational pattern, research at IRRI is organized by ecosystem, irrigated, rainfed, lowland, upland, deep water, plus a cross-ecosystems program to attend to subject matter that does not fall neatly into the ecosystem categories.

Other developments drawing positive comment from the review panel included staff changes with a consequent transfusion of new ideas; a range of improvements in the management of center affairs; and relations with national agricultural research systems that were creative as well as productive.

Mr. Walton commended WARDA for having responded to the challenge posed by the CGIAR in 1986 when the Group urged that the center should undergo a substantial transformation. In 1993, Mr. Walton said, WARDA is depoliticized and well managed with a soundly designed program that holds out the prospect of a significant impact within a reasonable time.

WARDA successfully reconciles its dual personality as an instrument of 17 member states in the region and as an autonomous international research center within the CGIAR system, Mr. Walton added. WARDA's Council of Ministers had proved to be an asset, providing the center with policy level access in all member states.

He commended WARDA's model of collaboration with national research systems, which is based on joint task forces that share out research tasks among WARDA and individual national systems on the basis of comparative advantage.

Noting that there is a strong need for rice research in West Africa, Mr. Walton said the review panel had examined various alternatives by which this research could be carried out - including a merger of WARDA with IITA - and concluded that WARDA remains the best option. WARDA must have a reasonably assured future, he said.

Mr. Scobie summarized the conclusions of the intercenter rice review within a framework of major issues such as population, equity, technological change, sustainability, and resource allocation.

The crux of the review panel's approach was that rice research in the CGIAR system should concentrate on global needs, both in its elaboration of research programs and in its allocation of resources. The current regional balance of funding is not aligned with the future needs for increasing rice production. Dealing specifically with the two rice centers, whose work was being discussed, the review argued that:

- IRRI, the center responsible for global commodity leadership and for Asia must have funding commensurate with its task, and
- WARDA cannot continue to operate as an independent commodity-based center for a relatively small region with reduced funding.

Mr. McCalla suggested that discussion of rice research issues should not focus solely on regional perspectives, a single region, or a single institution. The major issue was how best the CGIAR system could respond to the needs of developing

countries. The system's response would involve not only IRRI and WARDA but also CIAT, IITA, IFPRI, IBPGR, IIMI, and ISNAR.

Commenting on resource allocation for rice research in West Africa, Mr. McCalla noted that WARDA as an institution needs to be sustained but that it is at or below critical mass level. There was a need for research to be done, he added, on the sustainability of rice-based cropping systems in West Africa, and both WARDA and IITA have important roles to play.

The Group commended review chairmen and center representatives for frank and transparent presentations. There was general agreement on the need for rice research to continue within the system at a high level of intensity and intercenter collaboration. IRRI and WARDA were both commended for having managed a series of changes and for their willingness to continue undertaking other changes that might be necessary. IRRI's role as a flagship center of the system was recognized and the center was urged to "serve the whole world" with its efforts. IRRI's program emphases were considered to be consistent with the development needs it seeks to satisfy.

Some reservations were expressed about the case for a single center rice program in West Africa, and about the critical mass of scientists at WARDA. Overall, there was a consensus that the Group should continue to support WARDA.

Summing up the discussion, the Chairman said that the Group had reaffirmed the importance of rice as a crop that is the most used staple in developing countries. The external reviews of both centers were endorsed. TAC's recommendations on their MTPs would come up at ICW93 for decisionmaking by the Group. The Group wished that the CGIAR system should intensify and consolidate its rice research programs so as to continue its contribution toward increasing the productivity of rice and promoting the sustainability of production. The Group agreed that many centers should be involved in different aspects of this activity.

The Chairman said IRRI's role as a mature center that has made many innovations and is engaged in programs that are relevant to current production or environmental problems was widely acknowledged. IRRI was commended for its relations with national systems and for its development of creative partnership arrangements.

The Chairman noted a strong sentiment for the Group to continue supporting WARDA and encouraging its innovative mechanisms for collaboration with national systems. The Group felt that for WARDA to fulfil its role it should be funded at or about the current level. While WARDA was urged to continue its own research programs, it also was advised to undertake research partnerships with IITA on rice-based farming systems in the inland valleys of West Africa. WARDA's role in ecoregional research was viewed as requiring further elaboration.

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

Alex F. McCalla
Chair

19 April 1993

Dear Mr. Rajagopalan,

We are pleased to submit to you the Report of the Fourth External Programme and Management Review of IRRI which was conducted during September 1992 by a Panel chaired by Mr. David Bell of the USA. The Review Report and the Response of the IRRI Board of Trustees and management were discussed by TAC at its 60th meeting in March 1993 in the presence of Mr. Bell. IRRI was represented at the meeting by Dr. Walter Falcon, Chairman of the Board, Dr. Klaus Lampe, Director General, and Dr. Kenneth Fischer, Deputy Director General (Research).

This letter has two attachments in addition to the Panel's Report. The first contains the TAC Commentary, which is TAC's reaction to the Panel's Report. The second attachment is the Response of IRRI to the Report.

We are pleased to note that IRRI has gone through an in-depth institutional transformation and emerged as a very well managed Centre, with clearly defined and transparent priorities, a well focused research programme of high quality and a continued record of impressive achievements and farm level impact. The management problems that were evident at the time of the 1987 Review have been effectively resolved. TAC shares with the Panel the view that IRRI is still urgently needed to provide leadership in addressing the major challenges to rice research in developing countries.

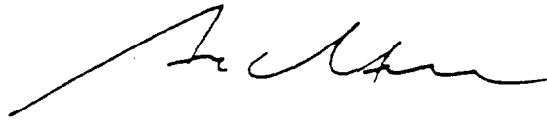
Mr. Visvanathan Rajagopalan
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The World Bank
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We recommend continued strong support to IRRI by the CGIAR. IRRI has an important mission to fulfil and the returns to CGIAR investment in rice research have been substantial.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Alex McCalla', written in a cursive style.

Alex McCalla
Chair, TAC

A handwritten signature in black ink, appearing to read 'Alexander von der Osten', written in a cursive style.

Alexander von der Osten
Executive Secretary, CGIAR

TAC COMMENTARY ON THE EXTERNAL REVIEW OF IRRI

TAC is grateful to the Chairman and members of the IRRI Fourth External Programme and Management Review Panel for a well-written and positive report. The Committee is pleased that, given the critical nature of the Third External Reviews of IRRI in 1987, the Institute has undergone an in-depth institutional transformation and emerged as a very well-managed Centre, with clearly-defined and transparent priorities, a well-focused research programme of high quality, and a continued record of impressive achievements and farm-level impact. The management problems that were evident at the time of the 1987 Reviews have been effectively resolved.

TAC has noted that the Panel's report, while lengthy, contains relatively few firm recommendations. The Committee urges members of the CGIAR to carefully consider the full report, which contains many useful suggestions. TAC endorses, in general, the recommendations of the Panel and offers the following commentary to supplement the Panel's work.

Evolution of IRRI

TAC is impressed by the scope and extent of the transformation that IRRI has undergone, as an institution, with guidance from its Board and Management, during the last six years. TAC sympathizes with IRRI and its staff for the hardship they have endured during this period of rapid change and institutional down-sizing. IRRI has found renewed vigour, is now substantially leaner and a more efficient research operation, appears to have in place a workable matrix research management system, and has able administrative and financial management. This is a credit to the outstanding leadership of the Director General and his senior managers. The directional changes of the Centre have a clear rationale, and most of the Centre's current research work is of a strategic nature. In addition, IRRI has developed effective mechanisms for strengthening national research systems, and is in the process of developing innovative consortia for collaboration with national programmes and other partners in conducting strategic research.

Research Programme

TAC shares the Panel's concern about the threat posed to food supplies by indications of decline, both in yield and factor productivity, in intensively-managed irrigated systems. TAC considers that these emerging sustainability problems in the most favourable rice-growing areas of Asia constitute one of the major issues that must be addressed through international rice research in order to meet the demand for rice. TAC encourages IRRI to make an effort to systematically collect additional information as to the extent and nature of this threat. In TAC's view, it would be premature to mount a 'man on the moon' effort on yield decline, as proposed by the

Review Panel, until the nature and extent of the problem(s) have been defined more precisely. Nevertheless, the Committee endorses the Panel's recommendation that IRRI should organize and lead a commensurate research effort in this regard, in collaboration with partners in national programmes and advanced research institutes. TAC will consider the scale of resources required for research on this issue within the framework of its consideration of IRRI's MTP.

The other major challenge is to lift the yield potential of rice, which has not increased significantly since IR8 was released in 1966. Several new approaches for raising the yield ceiling are being explored by IRRI. TAC recognizes that lifting the yield ceiling may possibly exacerbate the problem of sustainability, and does not therefore view the challenge of lifting the yield potential as being totally independent from the challenge posed by the decline in factor productivity.

Scientific Excellence

TAC concurs with the Panel's view that IRRI's future efficiency will depend to a large extent upon its current scientific excellence and the way in which it is maintained. The Committee agrees with the Panel that the emphasis placed on the programme side of the research management matrix may now need to be modified to help the divisions maintain and enhance their disciplinary strengths.

Ecoregional Activities

TAC notes the Panel's observation that IRRI must be cautious about assuming a major ecoregional responsibility for Asia beyond the ecoregional work for rice-based farming systems. The Panel's concern may have been based on its opinion regarding the risks involved in IRRI moving too far away from its central role of a global commodity institute for rice.

TAC is impressed by the attention given by IRRI to sustainability concerns and the extent to which research on natural resources conservation and management is integrated within IRRI's programmes. TAC further notes that centres with global crop mandates have an important role to play in increasing the understanding of the environmental requirements of their mandate crops and the implications for targeting germplasm enhancement and breeding activities. TAC will consider IRRI's ecoregional activities within the context of its medium-term proposals and the systemwide discussion of ecoregional approaches to research.

INGER

TAC draws the attention of the CGIAR to the Panel's observations on the global importance and effectiveness of INGER. The Committee shares the Panel's concern about the 50% reduction in funding for INGER since July 1991. TAC

would urge IRRI to aggressively explore options to ensure adequate funding for INGER, which plays a critical role in international rice research.

Relations with NARS

TAC appreciates IRRI's initiatives in developing additional innovative relations with national programmes through collaborative research networks (such as those on systems simulation and analysis in rice production) and consortia to address constraints to rice production in rainfed systems. These appear to hold promise for effective collaboration in strategic research on a partnership basis.

15 February 1993

Dear Drs. von der Osten and McCalla,

On behalf of IRRI's Board of Trustees and Management we are pleased to respond to the recommendations and helpful suggestions presented in the report of the fourth IRRI external program and management review.

The report gives a clear and perceptive account of IRRI's strategy, programs, and plans for the future; and provides insights into the changes made since 1988. In its recommendations, it also identifies a number of important activities which the Centre is anxious to strengthen.

We are grateful to the review panel for its thoughtful analysis of future rice demands and supplies in the various regions of Asia. We support the view that: "IRRI's research is still urgently needed to lead the way in addressing the most difficult research problems" and that there is a compelling case for continuing research in all major rice ecosystems.

The Board and Management are pleased with the review panel's approval of the overall directions and balance of IRRI's research activities and its support of the matrix-based research management system introduced in 1990. This system has made IRRI's goals in the various ecosystem-based research programs more explicit. At the same time, disciplinary excellence has been supported.

The Panel's conclusions regarding the major research priorities for the future are congruent with those of IRRI. These include the following:

- Critical problems of decline in factor productivity;
- Use of new and innovative technology, including molecular biology, to raise the yield ceiling of rice;
- Development and dissemination of Integrated Pest Management (IPM) technology; and
- Greater integration of the social sciences with concerns for IRRI's impact on disadvantaged rice consumers and producers.

We concur with these conclusions and agree that IRRI must continue strategic research on natural resource management as it impinges on the long term productivity of the rice systems, in addition to its research on the genetic improvement of rice. Thus, IRRI must continue its global responsibility as well as play a pivotal role for ecoregional research for selected rice-based agroecosystems in Asia.

IRRI will continue to respond with energy and enthusiasm to these challenges, within the capacity of its resources, and with the support and advice of its partners within the respective agroecological regions. In view of the magnitude of the problems and the size of the respective rice ecosystems, these tasks can and must be undertaken within new collaborative settings. IRRI has over the last few years initiated several forms of linkages with national systems and will continue to do so.

The request for widened responsibilities must also be linked to resource allocation. IRRI's rationalization efforts have already led to the:

- Abolishing of 720 positions;
- Freezing of Internationally Recruited Staff positions;
- Rationalizing and streamlining of operations; and
- Modernizing of facilities with consequent reductions in operational costs.

Given the present resources, we are considering the reduction of the size of the experimental farm at IRRI Headquarters, and undertaking another staff reduction program.

Our responses to the 11 specific recommendations made by the review team are attached. Beyond these 11 recommendations, the report contains a valuable set of proposals and expressed views which we have also carefully studied. We wish to assure you that IRRI's Board and Management will make full use of these suggestions in our ongoing effort to adapt the Institute and our work to continuously changing needs.

We would like to express our great appreciation to the Review Panel for the valuable report, and to the TAC and CGIAR Secretariats for the assistance and support provided to the review.

Respectfully submitted,



Klaus Lampe
Director General



Walter P. Falcon
Chairman, Board of
Trustees

Dr. Alexander von der Osten
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Att.: a/s

**IRRI's Board and Management Joint Response to the Report of the
Fourth External Programme and Management Review
of September 1992**

Chapter 3 - Research Programmes

Recommendation 3.1

The Panel, recognizing the threat posed to food supplies by yield decline and decreasing factor productivity in intensively managed ricelands, recommends that IRRI lead a major research effort enlisting the best talents available in the world, to seek solution for this complex of problems -- a task that may take a decade or longer to complete.

We agree with the External Review Panel's assessment of the seriousness of the stagnation in yield and the decline in productivity issues, and welcome their according such high priority to them. As the Panel rightly notes, these are highly complex issues which affect not only the goals of increasing productivity and farm incomes, but also the fundamental issue of sustainability.

There is strong evidence that these phenomena are not restricted to intensive rice systems. Some aspects may be common to other intensive cereal systems, such as the rice-wheat rotation. The kind of international effort involving institutions from both the rice-growing and industrialized countries, which the Panel has suggested, and the needed resources of \$50 million over 10 years are not unrealistic.

We are firmly committed, and have already begun, to seek answers to these problems. On the basis of available information, we are developing a number of hypotheses to guide experimentation to understand better the factors controlling the long-term sustainability of intensive systems. More work, however, is needed in the region to document the magnitude of the problem in farmers' fields. This information will also help refine the hypotheses upon which to develop a full research agenda.

In our view, this issue is a problem of fundamental importance that demands our immediate attention and concerted effort. The Panel's independent assessment leading to the same conclusion -- at a time when the medium term plan decisions for IRRI have to be taken -- is most encouraging.

Recommendation 3.2

The Panel recommends that IRRI explore the feasibility of combining with cultivated rice the ability of some wild species to grow under low solar radiation, in order to increase wet season rice productivity.

We feel committed to exploring a wide range of new and novel mechanisms that have the potential to enhance the productivity and sustainability of rice and rice-based systems. Examples include a new plant type with a target of 25-30% yield increase, symbiotic N₂ fixation in rice, and a perennial rice plant for the uplands.

We have used and continue to use the genetic variability of wild species of rice to enhance stability and durability to biotic and abiotic stresses. Indeed, much of our biotechnology initiative has been conducted to ensure our ability to transfer these genes through wide hybridization.

The Panel's recommendation to target improvement in the efficiency of photosynthesis at low light intensity will require further investigation. Many factors are involved. Their interrelationships and importance can best be examined initially by a process-based rice growth model that will define the range of productivity responses to changes in photosynthesis with changes in radiation. An *ex ante* impact assessment will guide the wide hybridization program.

Chapter 4 - Research Management

Recommendation 4.1

The Panel recommends that IRRI adjust the matrix management system to provide the Divisions more authority and means to strengthen disciplinary capabilities and rigour, and to ensure that the emphasis on ecosystem research programmes does not lead to an erosion of disciplinary expertise.

In this recommendation, the Panel has recognized the fundamental task of the matrix management system to balance between ensuring the dedication of a critical mass of scientists of several disciplines to the pursuit of solutions to a mission-stated problem and providing excellence in disciplinary knowledge and skills.

We judge this recommendation to be a restatement of the importance of that balance. We concur that the matrix must ensure outputs of disciplinary knowledge and capacity for vigour and excellence from the *divisions* along with outputs, technologies and tools from the *programs*. Our second medium-term plan (1994-1998) identifies resources for use by the divisions in pursuing and strengthening disciplinary knowledge and scientific vigour.

IRRI Management will continue to fine-tune the research matrix, and the Board and Management will carefully monitor the appropriateness of the outputs.

Chapter 5 - International Programmes

Recommendation 5.1

The Panel recommends that IRRI make every effort to mobilize required resources to protect the integrity and the worldwide effectiveness of INGER, and to maintain the high level of management capability required for INGER's success.

We appreciate and fully concur with the Panel's recognition of the importance of INGER. We firmly believe that INGER and the International Rice Germplasm Center (IRGC) are key activities of IRRI which have played and will continue to play pivotal roles.

INGER's evolution since 1989 testifies to our recognition of its vital role. It is true that funding constraints and the need for reorganization and rationalization of IRRI have forced a restructuring of INGER, with a concomitant prioritization and concentration of activities. We regard INGER as a vital component in our collaboration with NARS and an integral part of IRRI's core activity, and are making all efforts to seek the financial support needed for its full implementation. We have been successful in finding additional donor support for INGER regional activities in Africa, and are hopeful for the support of other INGER components as well. This will allow us to maintain the high level of management capability required for INGER's continuing success, to better serve our NARS collaborators.

Recommendation 5.2

The Panel recommends that, in replacing its retiring librarian, IRRI employ a professional who has demonstrated competency as an international leader in the diverse areas of library and information services management.

We fully agree with the Panel's recommendation. The valuable collection of the IRRI's Library is irreplaceable. The present head of IRRI's library has been the key person in the development of this unique accumulation of knowledge over more than 30 years. We agree that this treasure must be properly and effectively managed, and also kept up-to-date in view of new technologies. The Library information services need to be modernized through expanded application of electronic communication devices, to better serve the needs of IRRI and NARS scientists.

When the current Librarian retires at the end of 1992, we intend to search internationally for a highly qualified professional to assist us in further modernizing the Library service. Special funding has assured that the Institute will be able to renovate the Library, provide the collection with safe storage facilities, and install the electronic systems needed to serve scientists worldwide.

Recommendation 5.3

The Panel recommends that IRRI, together with colleagues from national research systems, seriously consider the future of and IRRI's participation in the two Networks: ARFSN and INSURF.

We are cognizant of the rapidly changing research and information environment within which the two networks operate. The establishment of the ecosystem-based research consortia places a different perspective on the role of these networks. In line with an IRRI Management initiated Peer Review on Networks, Management has begun in early 1992 discussions on the reorganization of existing networks. Several options are being explored, one of which is for the networks to operate around the ecosystems framework and to be closely associated with the research consortia. These options are now being discussed with our NARS partners, and corrective measures will be taken as part of the Medium Term Plan (1994-1998).

Chapter 7 - Organization and Management

Recommendation 7.1

The Panel recommends that the Board further improve the way it selects and orients its new trustees.

The Board is working to improve its procedures for selecting new Trustees -- a task that is a specific responsibility of the Nominating Committee of the Board and the general responsibility of the Board itself.

The current practice follows accepted procedures for CGIAR centres. Prospective Trustees are identified through an interactive process involving IRRI Board members, IRRI Management, and the staff of the CGIAR Secretariat, with the help of the Secretariat's new database of potential Trustees. In addition, the Board canvasses a wide range of other contacts in developing and developed countries to identify prospective Trustees.

The Board is aware of the need to maintain a balance between Trustees from industrialized- and agriculture-dominated countries, and for representation from the regions of the world where IRRI is most active. The selection also takes into account the need to have a range of appropriate professional experiences and skills represented in its membership.

The Board is working to increase the number of female Trustees (there will be two as of March 1993). All twelve elected Trustees serve in their individual capacities and, with the exception of the three additional *ex officio* members, all have terms of three years, renewable once.

The Board accepts that it can improve its orientation procedures for new Trustees, and has established a more formal procedure to do so. A new sub-committee of three trustees, including the Chairman, has accepted the responsibility of ensuring that all new Trustees are effectively briefed before their first Board meeting. In addition, new Trustees will arrive early for their first Board meeting, so that they may be briefed by the Chairman and one or more experienced Trustees, meet the staff, and be given a guided tour of Institute facilities.

Recommendation 7.2

The Panel recommends that future peer reviews include a critical assessment of scientific quality.

IRRI's peer review process is an instrument for internal monitoring and evaluation. The reviews are management initiated and conducted by outside peers. They have replaced the previous system in which individual scientists presented their results in a seminar type of exercise.

A variety of areas has been reviewed, and our experience over the last years suggests opportunities for further improvement. Two elements that we want to improve further are that

- peer review team members be identified independently of the group being reviewed, and
- the scope and terms of reference of the review be identified by Management and be sufficiently precise and focused to ensure full coverage of research excellence.

This recommendation of the Panel is, therefore, fully endorsed. Scientific quality and relevance have been and are key concerns of IRRI. The introduction of management-initiated external peer reviews is one of the tools to ensure high quality. The written reports of review panels document are only part of the outcome of the reviews. Thorough discussions, both on and off the record, between the Panel Members and Management give additional insights and bases for decisions.

Recommendation 7.3

The Panel recommends that IRRI continue to conduct impact assessment studies.

We appreciate the Panel's confirmation of the importance of impact analysis. We interpret this recommendation as supportive of both *ex ante* and *ex post* assessments.

We place high importance on *ex ante* impact assessment as a component in setting priorities, assessing equity and environmental impacts, and planning better use of scarce resources.

In the past, IRRI socioeconomic activities included involvement in large *ex post* impact studies. In the future, we will be increasingly selective in undertaking such studies, with the primary focus on collaborative studies with NARS.

Chapter 8 - Administration and Operations

Recommendation 8.1

The Panel recommends that in reality the HRD Manager report directly to the DDG for Finance and Administration and that human resource management responsibilities be consolidated.

We concur with the Panel's recommendation. In the current organizational structure, both the Director for Administration, who handles IRS personnel matters, and the HRD Manager, who handles NRS personnel matters, report to the DDG for Finance and Administration. This structure will be implemented more strictly when the position of the HRD Manager, which has been vacant since April 1992, is filled.

Recommendation 8.2

The Panel recommends that the Chief Security Officer position be filled by a person from outside IRRI's present staff and that IRRI increase the proportion of contract security officers among its security staff.

We appreciate the importance the Panel has placed on the security issue at IRRI. We have, for several years, initiated steps to improve security, and we will continue to do so with the Panel's suggestions duly noted and with the special care needed in the local environment.

23 September 1992

Dr. Alex McCalla
Chair
Technical Advisory Committee
Consultative Group on International Agricultural Research
c/o University of California
Davis, CA 95616, U.S.A.

Mr. Alexander von der Osten
Executive Secretary
Consultative Group on International Agricultural Research
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Dear Dr. McCalla and Mr. von der Osten,

It is my pleasure to transmit to you, for the consideration of the TAC and the CGIAR, the Report of the Fourth External Review Panel appointed to assess the International Rice Research Institute. My colleagues and I have reviewed, as requested, both the programme and the management aspects of IRRI's work. Being required to look at both aspects simultaneously has made our work in some respects more complex, but we believe the combined assignment has yielded substantial benefits in the coherence and balance of our analysis and recommendations.

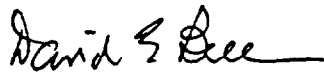
As the Report makes clear, we have found IRRI well along in a radical transformation of its programme objectives, staffing, organization, and management, as it seeks to put into effect its Strategic Plan, *IRRI Toward 2000 and Beyond*, and the recommendations of the Third External Programme and Management Reviews. While it is too early to measure the outcome with precision, the Panel believes IRRI is accomplishing what it set out to do: to increase its emphasis on strategic research without losing touch with the real life of rice farming families; to strengthen its attention to the problems of rice production in less favoured environments while maintaining its essential focus on sustainable increases in total rice output; and to reflect considerations of equity and natural resource management more fully in its priorities and programmes. We have been deeply impressed by the dedication and energy with which the management and staff of IRRI have been pursuing the transformation of its life and work. Our recommendations are intended to assist IRRI as it completes the transformation and moves ahead with its vital mission.

.../2

The Panel has received cooperation and assistance from many quarters. First and foremost, our work was made easy and pleasant by the unstinting and efficient assistance of IRRI's Board, Director General, and entire staff. We are very grateful for their courtesies and kindness, which often involved long hours and much inconvenience. We are grateful to the numerous agricultural scientists and government officials who shared with us, in many parts of the world, their perceptions of IRRI and its activities - especially to those who received us so warmly during the Panel's visits to the Philippines, Indonesia, Thailand, India, and Egypt. Finally, we have benefitted enormously from the participation in our review by excellent, widely-experienced colleagues assigned by the TAC and the CGIAR Secretariats: Amir Kassam from the TAC Secretariat in Rome, and Selcuk Ozgediz and Don Plucknett from the Group Secretariat in Washington.

In closing, I speak for all the Panel members, including myself, in expressing our gratitude for the opportunity to take part in this Review. We have all been highly impressed by the quality of IRRI's staff, both international and national, and by their strong commitment to IRRI's mission. We hope this report will assist them in their important work.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "David E. Bell", with a long horizontal flourish extending to the right.

David E. Bell, Chair
External Review Panel

THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
TECHNICAL ADVISORY COMMITTEE AND CGIAR SECRETARIAT

REPORT OF THE FOURTH EXTERNAL PROGRAMME
AND MANAGEMENT REVIEW OF
THE INTERNATIONAL RICE RESEARCH INSTITUTE
(IRRI)

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

September 1992

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FOREWORD

This is the Report of an External Review Panel appointed to review the programme and management of the International Rice Research Institute (IRRI). The membership of the Panel and their backgrounds are listed in Appendix I.

This Fourth External Review of IRRI (main phase September 1992) was commissioned in October 1990, simultaneously with the commissioning of the Third External Review of WARDA (main phase January 1993) and the Inter-Centre Review of Rice (main phase February 1993). To provide effective links between the three rice review panels, a member from the IRRI Panel and a member from the WARDA Panel are serving also on the Inter-Centre Panel. The reports of the three rice reviews are scheduled to be considered by TAC in March 1993 and by the CGIAR in May 1993.

The detailed Terms of Reference for the Fourth Review of IRRI are shown in Appendix II. In broad outline, the Panel was asked:

- to assess the recent evolution of IRRI, its mandate, strategy, programmes, organization, and management;
- to review the methods and processes used by IRRI to ensure quality and relevance in its activities, services, and outputs;
- to assess the effectiveness of management, including leadership, values, and culture;
- to review the ways in which IRRI collaborates with other institutions within and outside the CGIAR;
- to assess IRRI's achievements and impact; and
- to assess the adequacy of the facilities and resources available to IRRI in relation to its current and future scale of activities.

The information and evidence on which the Panel based its response to the Terms of Reference were gathered in several ways. The Panel spent a week at IRRI in April of this year and three weeks in September, in each case interviewing and meeting with the Board, the management, and many members of the staff and their spouses. In groups or singly, the Panel visited agricultural scientists, government officials, and others knowledgeable about rice in the Philippines, Indonesia, Thailand, India, and Egypt. The Panel also benefitted from the report of a visit to China by the Inter-Centre Review Panel. During the summer, Panel members discussed IRRI with officials of several CGIAR member governments and organizations, and with agricultural scientists familiar

with IRRI in some of the industrialized countries. Visits were also made by a Panel member to CIAT, and by Panel staff to IITA and WARDA. A list of institutions and individuals visited is shown in Appendix III.

In addition to visits, the Panel gathered information through several surveys: a questionnaire sent to a wide cross-section of rice scientists and research leaders in developing countries (the results are summarized in Appendix IV); a survey of IRRI Board members; responses to a letter sent to other CGIAR Centres collaborating with IRRI; a survey of IRRI scientists asking their views of the matrix system now being used at IRRI for research management; and responses to a letter sent to all IRRI employees by the Panel Chair inviting their comments signed or unsigned.

Finally, the Panel had access to the full array of reports and databases available at IRRI, and asked IRRI for a number of special reports. We tried to keep the latter to a minimum, and were able to do so because nearly everything we wanted was available as part of IRRI's normal reporting systems. A list of documents made available to the Panel is shown in Appendix V.

Altogether, we believe we were able to obtain sufficient data to enable us to respond with some confidence to our terms of reference. We certainly do not claim to be fully informed on every aspect of IRRI's work and circumstances. But we consider that we have sound evidence on which to base the analysis, conclusions, and recommendations presented in this Report. We hope the Report will be useful to TAC, to the CGIAR, and most of all to IRRI itself.

SUMMARY AND RECOMMENDATIONS

The CGIAR External Reviews of 1987 found IRRI needing greater clarity and focus in its strategic directions and significant improvement in its management and organization. This External Review finds an IRRI that is visibly different in both scientific and management terms - in many ways a rejuvenated IRRI - an IRRI that has higher promise to lead the world of rice research into the next century.

The main dimensions of IRRI's transformation are:

- a new strategy that is grounded in, and takes its rationale from, the needs of IRRI's clients - present and future generations of rice farmers and consumers - and, in general, provides a clear vision of what IRRI intends to do;
- a new programme structure that organizes research objectives in terms of major rice-based ecosystems, and a matrix-based research management system that attempts to provide a balance between achieving programme objectives and furthering disciplinary excellence;
- a new cadre of scientists and managers who are equipped with up-to-date techniques and methods, and a capable, but much leaner nationally-recruited staff;
- a completely renovated physical infrastructure and experimental farm that is likely to serve the institution well for years to come;
- a Board of Trustees that functions as well as any within the CGIAR System and new administrative and financial systems that facilitate reporting and reinforce accountability; and, most important:
- a team of scientists who understand and communicate well with each other.

The institutional transformation of IRRI is not yet complete. Many of the new systems are still at an experimental stage and staff are learning how to work best within the framework of the research programme matrix. The management systems and procedures introduced have placed a considerable administrative burden on scientists and science managers. As a result, IRRI's internationally recruited staff are currently overstretched.

Is There Need for Rice Research?

While IRRI has prepared itself well for future research tasks, will there be a continuing need for an international institution like IRRI?

The Panel's analysis of this question shows that although the current supply of rice appears favourable and rice prices are low, there is cause for concern because:

- production of cereals in the poorer regions will fall short of their demand for at least the next fifteen years;
- the current low rice prices have led to sharp curtailments in investments in irrigation and research;
- future yield increases will not come easily;
- yields in some of the more intensively cultivated parts of the irrigated lowlands are beginning to decline.

Hence research is still urgently needed, and IRRI is still urgently needed, to lead the way in addressing the most difficult research problems. The causes of the decline in rice yields have to be understood and remedial measures found. The ceiling on yields in irrigated areas has to be lifted. The problems of rice production in less favourable areas, where most poor people live, need to be addressed.

Such research requires the best scientists from advanced and developing countries and international centres. IRRI is needed to mobilize and energize them.

Is IRRI on the Right Track?

The Panel believes so. Properly, IRRI continues to conduct key strategic research on germplasm enhancement and its widespread use. Organization of the research programme in terms of ecosystems has placed rice improvement in the wider context of the environment and the farming system in which the crop is grown. Also, the ecosystem approach has made more explicit IRRI's goals concerning the less favourable rice production environments.

The Panel has identified one major research need - the yield decline problem - that in our opinion is so large and so serious as to threaten the sustainability of the most productive rice lands, the intensively managed irrigated areas. To meet this problem requires, in our view, a major international research initiative enlisting scientists from around the world in a sustained effort for a period on the order of a decade and on a scale on the order of 50 million dollars over a decade. We believe IRRI should take the lead in organizing this effort.

Generally speaking, the overall directions of IRRI's programmes are appropriate, as is the current balance of effort across programmes. IRRI has had to introduce deep cuts in its planned mix of research projects because of funding shortages. These have limited the Institute's flexibility.

Does IRRI Have a Good Record of Achievements?

IRRI's long term achievements are well known. It has played an important part in the scientific advances that have brought about a doubling of world rice production since the mid-1960s. The Panel has found much evidence of IRRI's continued scientific productivity over the last five years as well. Among its research outputs have been:

- the design and development of higher yielding plant types by an interdisciplinary team of breeders, physiologists and modellers - a new plant type for the high production environments that aims to raise potential yields from the current 10-11 t/ha to 15 t/ha;
- successful hybridization with 12 species of wild rice to transfer genes for resistance to pests (e.g., brown plant hopper) and diseases (e.g., blast) into cultivated rice; and,
- research on component technologies for integrated pest management, such as pest-population dynamics, resistant cultivars, and biocontrol to minimize pesticide use.

IRRI's research-related services to and collaboration with national rice research systems have also continued:

- worldwide distribution of specifically targeted genetic materials through many collaborative channels, such as through the International Network for the Genetic Evaluation of Rice (INGER), which in 1992 distributed to 35 countries 921 sets of 23 different types of nurseries aimed at such problems as pests, diseases and drought; and
- collaborative research with many national systems and provision of training programmes focusing increasingly on strategic research topics, such as rice biotechnology; hybrid seed production; simulation and systems analysis in rice production; and quantitative methods in pest ecology.

Very promising for the future, in the Panel's view, is evidence of important innovation in approaches to research:

- development of a new approach to collaborative research through consortia (for the upland and rainfed lowland ecosystems) and research networks to encourage research using advanced methods;
- collaborative work between social scientists and natural scientists in characterizing the farming systems of the less favoured environments to identify the key areas for research;
- establishment and enhancement of a biotechnology research capacity in tissue culture, development of techniques for successful regeneration of plants from protoplasts, and linkage studies with DNA markers enabling gene mapping;
- establishment of a modelling capability to assist in several key areas of research including: prediction of yields in relation to the environment, nitrogen management and sustainability of high yielding systems, designing new plant types, and linking with Geographical Information System data for environmental characterization.

Looking ahead, the Panel would anticipate fairly rapid progress on some issues, such as obtaining useful genes from wild species. On some of the harder tasks, such as yield decline and increasing production in less favourable environments, progress will necessarily be slower.

Is IRRI Managed Efficiently?

The short answer is "yes, but...". IRRI has gone through a radical transformation and it will take some time for the Institute to reach stability. In the meantime, inefficiencies are being and will continue to be experienced and these need to be attended to by the Board and management.

IRRI's future efficiency will depend to a large extent on its current scientific excellence and how it is maintained over time. This is in part a function of how IRRI fosters and maintains scientific quality and excellence in the divisions. The emphasis placed (rightly) on the 'output' side of the matrix at the beginning of the shift to a new research management system now needs to be modified to help the divisions maintain and enhance their disciplinary strengths.

The systems and procedures introduced over the last five years for managing financial, human, physical, and information resources of IRRI are a vast improvement over what existed five years ago. IRRI manages its finances well, and the external and internal audit functions are effective. There is need, however, to strengthen further the human resource management function, particularly for the nationally recruited staff. IRRI's information technology is moving in the right direction, but it has some distance to go.

Should IRRI Undertake Additional Responsibility in the CGIAR?

The Panel has three comments.

First, as the System's global commodity centre for rice, IRRI must attack the hardest scientific problems concerning rice in less favourable as well as more favourable environments.

Second, IRRI should give the bulk of its attention to Asia, where more than 90 percent of the world's rice is produced. Roles of the different CGIAR centres working on rice research in Latin America and Africa are being examined by the review panel commissioned to look into inter-Centre rice research issues in the CGIAR.

Third, IRRI has before it a full plate of important, challenging and unfinished research on rice-based ecosystems. Its work on these ecosystems has placed IRRI squarely in the midst of natural resource management research issues of a strategic nature relating to the major ecoregions in Asia. IRRI's new strategy has given the Institute a dual responsibility: global commodity work and ecoregional work for rice-based ecosystems in Asia. The Panel finds this a highly appropriate assignment which will require all of IRRI's energy and resources for the next few years. We believe that it would be a mistake for IRRI to make a premature commitment to a broader ecoregional role.

LIST OF RECOMMENDATIONS

Chapter 3 - Research Programmes

- 3.1 The Panel, recognizing the threat posed to food supplies by yield decline and decreasing factor productivity in intensively managed ricelands, recommends that IRRI lead a major research effort, enlisting the best talents available in the world, to seek solutions for this complex of problems - a task that may take a decade or longer to complete.
- 3.2 The Panel recommends that IRRI explore the feasibility of combining with cultivated rice the ability of some wild species to grow under low solar radiation, in order to increase wet season rice productivity.

Chapter 4 - Research Management

- 4.1 The Panel recommends that IRRI adjust the matrix management system to provide the Divisions more authority and means to strengthen disciplinary capabilities and rigor, and to ensure that the emphasis on ecosystem research programmes does not lead to an erosion of disciplinary expertise.

Chapter 5 - International Programmes

- 5.1 The Panel recommends that IRRI make every effort to mobilize required resources to protect the integrity and the worldwide effectiveness of INGER, and to maintain the high level of management capability required for INGER's success.
- 5.2 The Panel recommends that, in replacing its retiring librarian, IRRI employ a professional who has demonstrated competency as an international leader in the diverse areas of library and information services management.
- 5.3 The Panel recommends that IRRI, together with colleagues from national research systems, seriously consider the future of and IRRI's participation in the two Networks ARFSN and INSURF.

Chapter 7 - Organization and Management

- 7.1 The Panel recommends that the Board further improve the way it selects and orients its new Trustees.
- 7.2 The Panel recommends that future peer reviews include a critical assessment of scientific quality.
- 7.3 The Panel recommends that IRRI continue to conduct impact assessment studies.

Chapter 8 - Administration and Operations

- 8.1 The Panel recommends that in reality the HRD Manager report directly to the DDG for Finance and Administration and that human resource management responsibilities be consolidated.
- 8.2 The Panel recommends that the Chief Security Officer position be filled by a person from outside IRRI's present staff and that IRRI increase the proportion of contract security officers among its security staff.

CHAPTER 1 - A PERSPECTIVE ON RICE RESEARCH

1.1 The Future of Rice in Asia

Superficially, the problem of rice availability in Asia would appear to have been solved. Since 1966, when IRRI first released its IR8 variety, world paddy production has nearly doubled from 261 million tonnes (with Asian production at about 240 million tonnes) to 519 million tonnes (Asian production: 479 million tonnes) in 1990. Production has expanded faster than population, which has grown 1.6 times in Asia during the same period by an amount enough to accommodate the increasing per capita demand arising from increasing incomes. In some countries, the income increase is itself to a significant degree a consequence of the increased productivity of their rice farmers. A measure of that success is partly reflected by the fall in the real price of rice in the world markets, which has touched historic lows in the last five years (Figure 1.1). Responding to the low rice prices, the multilateral agencies have been cutting down their lending to finance irrigation. Governments now no longer feel as pressed to support agricultural research as they did.

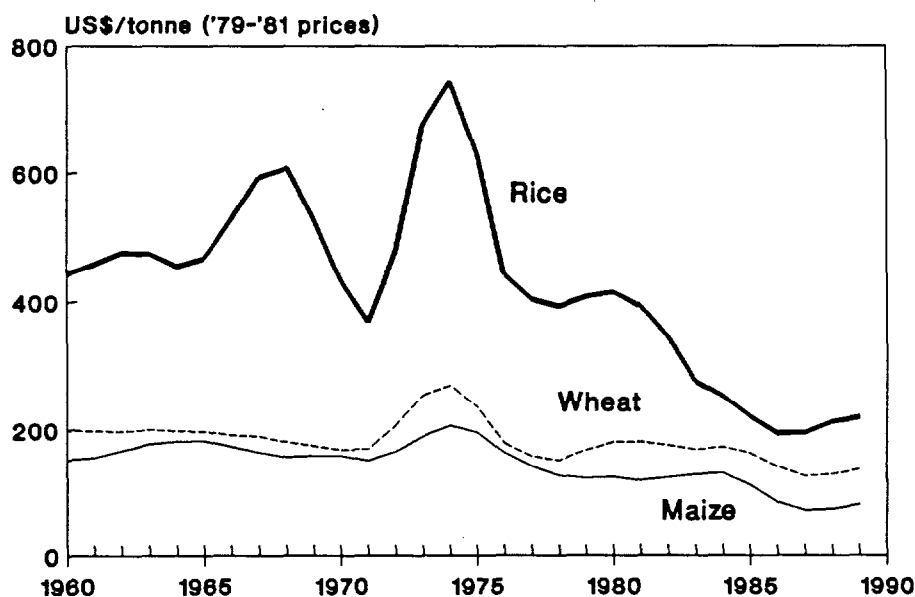


Fig. 1.1 Trends in World Prices of Rice, Wheat and Maize (US\$/tonne)
Source: IRRI, Social Sciences Division. Original source: World Bank.

Looking to the future, the rate of growth of demand for rice is expected to slacken off from 2.80 percent annual rate between 1966 and 1988, to 2.11 percent rate between 1988 and 2005, well above the expected population growth rate of 1.5 percent per annum. Extrapolating using past growth rates from a 1988 base, it is expected that production will grow at the rate of 2.02 percent between 1988 and 2005. The shortfall of production below domestic utilization will be of the order of 3.5 million tonnes (paddy equivalent) in 2005.¹ Table 1.1 provides the actual tonnage figures for production and consumption in Asia. These figures do not appear to be unmanageable when set against the current volume of trade which stands at about 18-21 million tonnes (paddy equivalent).

Table 1.1 Current and Projected Production and Consumption Levels of Rice and Wheat in Asia, 1988 and 2005 (mn. tonnes)

	1988			2005		
	Production	Consumption	Net Balance	Production	Consumption	Net Balance
RICE:						
China	171.8	170.8	1.0	236.9	238.5	-1.6
India	94.9	94.6	0.3	148.1	150.2	-2.0
Southeast Asia	104.1	101.1	3.1	150.3	149.6	0.7
East Asia (excluding China)	27.5	26.7	0.7	32.8	29.7	3.2
South Asia (excluding India)	33.8	33.5	0.2	50.5	53.2	-2.8
Other Asia	0.1	1.0	-0.9	0.1	1.1	-1.0
MONSOON ASIA	432.0	427.7	4.4	618.8	622.3	-3.5
WHEAT:						
China	85.6	102.3	-16.6	129.1	145.8	-16.7
India	44.5	45.3	-0.8	68.2	69.0	-0.8
Southeast Asia	0.2	4.1	-3.9	0.4	7.2	-6.8
East Asia (excluding China)	1.8	12.0	-10.2	2.6	13.5	-10.9
South Asia (excluding India)	16.1	20.3	-4.2	23.8	32.3	-8.5
Other Asia	0.0	0.6	-0.6	0.0	0.6	-0.6
MONSOON ASIA	148.1	184.5	-36.4	224.0	268.4	-44.42

Note: Other Asia includes Fiji, Papua New Guinea, Hong Kong and Singapore; China includes Taiwan.

Source: International Food Policy Research Institute, *Food Supply, Demand and Trade in Asia: Regional Trends and Projections*, Washington, DC, May 1992.

But complacency is unjustified, for three reasons. First, the aggregate shortfall projections conceal the fact that among the various subregions, East Asia (Japan, North and South Korea) would have a surplus of some 3.2 million tonnes (paddy equivalent) in 2005. It is well known that rice production in these countries (entirely of japonica rice) takes place under extremely high-cost and uneconomic conditions, and will continue to do so in the future. That surplus will not be available for the rest of Asia where people in any case consume mainly indica rice.

¹ These are preliminary figures from IFPRI, *Food Supply, Demand and Trade in Asia: Regional Trends and Projections*, Washington DC, May 1992.

Furthermore, concentrating exclusively on rice projections overlooks the fact that all of Asia is projected to be short of wheat by more than 40 million tonnes. China alone is expected to be importing more than 16 million tonnes of it in 2005. South Asia except India (which will remain self-sufficient) is projected to import a further 8.5 million tonnes of wheat in 2005. Considering that imports on this scale would drain the foreign exchange resources of the importing countries enormously, it is clear that in many parts of rice-eating Asia, the food position will remain precarious.

Second, the projection is based on increments to the current demands and supplies in the various Asian regions. It therefore has a strong bias toward linearly extrapolating the present. Experience shows the error of this approach. It was quite common for projections coming out during the late 1970s and the early 1980s to show extremely large and continued food deficits among developing countries. While developing countries continue to have to import food, the volumes imported are not as large as projected.

We have to be additionally cautious regarding the projections because the world rice market has a long cycle, whose mechanism runs as follows. Food surpluses give rise to low market prices internationally (as in the 1960s); the multilateral lending agencies are reluctant to invest in irrigation because these schemes would never pass the project evaluation test; and governments consider it less necessary to invest in research. Population growth however remains independent of such considerations, as is, to some extent, income growth. Over time the demand growth catches up. It then takes a year of bad weather (1972-73) to see food prices skyrocketing, and prognoses of a continued food crisis. The lending agencies then find that irrigation investments would pay off handsomely, and governments find it useful to invest in research and to provide fertilizer subsidies (as they did after 1975). As these various measures begin to bear fruit, the long decline in world rice prices would then begin (as it did in 1981), as would the slashing of irrigation investments and of research expenditures, completing what may be called the irrigation-rice cycle (the term is employed in analogy to the well-known corn-hog cycle which it resembles except in time scale).²

² The behavioural relations that give rise to the cycle are well documented, some of them by work done at IRRI. Thus the correlation between world rice prices and irrigation expenditures was shown as far back as in 1978 in Yujiro Hayami and Masao Kikuchi, *Investment Inducements to Public Infrastructure: Irrigation in the Philippines. The Review of Economics and Statistics*. Vol. 6 No. 1, 1978. The decline in research expenditures in response to world rice prices is also documented, see Y. Hayami and K. Morooka, *The Market Price Response of World Rice Research Agricultural Economics Department paper #87-21*. Los Baños, Philippines: International Rice Research Institute, 1987.

The same behaviour that generates the cycle is still with us: irrigation investments by the multilateral lending agencies continue to be curtailed,³ and the CGIAR System itself now lives in an atmosphere of austerity and retrenchment. If this behaviour pattern is not reversed by a conscious act of policy, then the current and projected favourable food supply situation will reverse itself. Already there is evidence at both the macro and the micro levels that yield increases are no longer as easy to attain as before. Table 1.2 shows that in all major producing regions in Asia, with the exception of India, yield increments have fallen in the last five years. (In the case of India, much of the gains have been due to the increased yields in the previously technologically lagging states such as West Bengal and Bihar.) Over all, there appears to be a negative correlation between the yield level already attained and the further increment that can be achieved, suggesting some sort of a ceiling.

Worse, and here we come to the final and probably the most important argument against complacency, in irrigated areas which have been the prime beneficiaries of IRRI's work in the past, the yields are not only constrained by some sort of a ceiling but the ceiling (measured by yields in the experimental stations) itself appears to be slowly coming down. Indeed, yields are in decline in the intensively cropped systems. The kind of agriculture that is now practised in irrigated paddies across Asia is more intensive than anything the world has ever seen. With yields in excess of 5 tonnes per crop per hectare, and with two or three crops a year, it was only a matter of time before the question of sustainability would arise. That time has now come, and we have only a weak understanding of the processes at work.

The problem of irrigated rice areas, with high external inputs, is particularly important, as they supply 70 percent of the world's rice. The current favourable supply position and the gradual pace of the yield decline give us some time to work on the many problems that will have to be addressed to make irrigated rice cultivation sustainable and yet continue to give the high yields on which the world has come to depend. But the scientific questions will be very hard to solve, as some fundamental questions will have to be addressed, and it is urgent to get on with the work.

If increasing rice yields in the irrigated areas is beset by so many difficulties, perhaps research should turn to the rainfed lowlands, uplands and deepwater areas. Although it must be stated at the outset that research into these areas brings results only reluctantly, the case for IRRI working in these areas is compelling. About 30 percent of Asia's rice-growing area is classified as rainfed lowlands. With the yield ceiling becoming increasingly binding in the irrigated areas, if work in this area succeeds, the result can be dramatic.

³ The combined support to irrigation by the World Bank, the Asian Development Bank, the Overseas Economic Cooperation Fund (Japan) and the U.S. Agency for International Development, is now half the levels reached at its peak in 1977-79. Public irrigation expenditures among the national governments have also fallen by between 15 to 60 percent. (Mark W. Rosegrant and Mark Svendsen, *Irrigation Investment and Management Policy for Asia in the 1990s*, mimeo. Washington, DC, International Food Policy Research Institute, August 1992).

Table 1.2 Yield Levels and Increments

	Average Yield (t/ha)	Yield Increments (kg/ha/yr)			
	1986-90	1950-65	1965-75	1975-85	1985-90
MONSOON ASIA	3.5	26	42	81	60
China ^{a/}	5.5	33	84	216	39
India	2.4	23	22	44	93
Rest of Monsoon Asia (indica)	2.8	24	31	66	49
Rest of Monsoon Asia (japonica)	6.3	77	83	74	2
SUBSAHARAN AFRICA	1.6	19	5	8	35
West Africa	1.4	19	14	14	22
Other Africa	1.7	19	-14	0	58
SOUTH AND CENTRAL AMERICA	2.4	3	7	43	70
REST OF THE WORLD	5.0	93	31	44	69
Developed	5.5	107	15	51	110
Developing	4.1	90	33	23	2
WORLD	3.4	26	40	75	62

Note: ^{a/}For China the third and fourth columns cover the periods 1965-78 and 1978-85

Source: IRRI, World Rice Statistics 1990. Original Source: FAO.

Another reason why the rainfed lowlands need more attention is the concentration of poverty there. According to the World Bank's estimate in 1985, 525 million out of the developing regions' 1125 million poor people lived in South Asia. Most of them are located in the rainfed lowlands in Eastern India, Bangladesh and the Tarai region in Nepal, where rice is the major crop.

The uplands demand attention for the same reason. Their contribution to world rice production is marginal, of the order of 10 percent or less, and it is unlikely that rice is the most profitable crop from a commercial point of view. However, the uplands are home to some of the poorest farm communities. That they are growing rice at all reflects their disadvantage rather than their advantage: they simply have no access to markets, and therefore cannot exchange more profitable crops for rice. As long as there are such communities, IRRI has to be concerned with them, as part of its mandate requires that it should pay due regard to the concerns of the poorest people in the region.

1.2 Rice outside Asia

IRRI is singularly fortunate to be assigned to work on rice in Asia (more strictly speaking, Monsoon Asia). For very few other commodities and regions can it be said that the commodity defines the region and *vice versa*. The region supplies slightly more than 90 percent of the world's rice and consumes just as much. For most people living in the region, except for Pakistan and important sections of China and India, rice provides more than two-thirds of the calories.

The role of rice is important in some regions outside Asia, but nowhere is it as predominant. In sub-Saharan Africa, only Madagascar and parts of West Africa have populations that eat rice as their staple food. Even though the total volume of rice production in this region is small, about 6-7 million tonnes of paddy, the fast population growth in these regions has made the task of meeting their food needs urgent. The problem is underscored by the fact that the region imports about 1 million tonnes (paddy equivalent) of rice every year.

South and Central America is another region with rice production scattered throughout. It produces about 18 million tonnes of paddy, and is almost self-sufficient.

1.3 The Historical Role of Research

It is difficult to discuss IRRI without harking back to its achievements with IR8 and succeeding varietal improvements. The point man of IRRI's success was the plant breeder. Embodying the technology in the seed had one big advantage: it facilitated immensely the transfer of technology. Because the technology transfer was less complicated, the diffusion was extremely rapid, and Asia's rice production, as we have seen, has since grown on a sustained basis for the following twenty-five years.

The success of IRRI's formula also convinced many Asian governments of the importance and the usefulness of agricultural research, and at least for a time, to put increased resources at the disposal of their National Agricultural Research Systems (NARS). More importantly, its scientific success has led them to follow IRRI along its road to success, which means that they have also concentrated their efforts on varietal improvements to meet the requirements of their farmers and consumers. Varietal improvements, at least for the irrigated lowlands, have become routinized and fully absorbed in many Asian NARS.

Even at the height of his success, however, the plant breeder could not have achieved his aim single-handed. To achieve his goals, he needs the work of the agronomist, plant physiologist, pathologist, entomologist, soil scientists and a whole array of other biological and social scientists, collaborating closely with the clear goal of achieving a sustained increase in rice yields. In this also, IRRI has been an important role model for the NARS in Asia.

Just as importantly, the plant breeder's task requires that he has at his disposal a germplasm bank. The largest collection of rice germplasm in the world is now

held by IRRI, and it serves the world's scientific community. Including capital cost and salaries, IRRI's germplasm centre probably costs slightly in excess of US\$1 million per year. Considering that of all varieties of rice currently planted, two-thirds have at least one grandparent from IRRI's germplasm bank, we can easily see how cost-effective this part of IRRI is.

This account of rice research has stressed the role of varietal improvement in increasing yields. It is often the most visible and measurable of a research centre's output. Equally importantly, however, a centre has to devote a significant proportion of its activities to resource management. Of course, a plant has to interact with its environment, and its capacity to do so will vary with the type of environment that it faces. The success of a centre in varietal improvement work depends on coming out with a seed that will be productive in as wide an area as possible. Here again, IRRI has been singularly fortunate, for the soil and water conditions of the (properly) irrigated paddy environment are remarkably uniform in geographically quite disparate regions. IR8 could be and was spread over a wide area, as were its successors.

As research shifts toward the rainfed lowlands and the uplands and as yield declines in the irrigated areas demand increasing attention, work on resource management has to be stepped up and take a greater share of research funds available. In the atmosphere of retrenchment that now pervades both the International Agricultural Research Centres (IARCs) and the NARS, exertion of more effort in this area implies an absolute reduction of effort in varietal improvement work. The technology of classical varietal improvement research is now, thanks in part to IRRI and its training programme quite widely dispersed among the Asian NARS. But with the yield ceiling in irrigated rice yet to be pierced, and new breeding goals to be met for different environments, strategic research on germplasm by IRRI, involving considerable doses of biotechnology, remains urgent.

On resource management research in rice-based systems, IRRI is almost compelled by its new ecosystem approach to expend considerable effort. Research in this area must be expected to have a long pay off period, and its output may not be as visible and measurable as in the case of varietal improvements. But given the situation that is now facing us, expenditure of resources in this area is urgent.

1.4 Challenges for Rice Research

Yield decline in irrigated areas

Yield increases that have been achieved and are now routinely expected should not blind us to the fact that nature gives up her resources only reluctantly and sooner or later exacts her price. The yield decline that currently afflicts only the experiment station and the more advanced farmers is a forewarning of that price. It would be extremely remiss of the rice research community to ignore the warning. It will be an enormous undertaking simply to sustain past yield increases in irrigated areas where resources are currently strained to the utmost. The work needed to be done is highly complex, requiring an interdisciplinary attack on the problem. We should have

no illusion: results that are practicable on farmers' field are uncertain and long-term. But this is an undertaking that cannot be shirked or postponed.

Lifting the yield ceiling

Perhaps it may be possible to pierce the yield ceiling that has been imposed by the plant design of IR8. Ever since its introduction, there has not been a variety that could break through that ceiling substantially. To do so, a radical approach is needed. Some recent work at IRRI suggests that a total redesign of the rice plant is necessary. With the key proviso that this method of increasing yields will be sustainable in the long-run, researchers should continue to explore ways of breaking the yield ceiling.

Germplasm improvements and biotechnology

A new emphasis on sustainability does not imply that work on varietal improvements should be suspended. It is an oversimplification to identify varietal improvement solely with yield increases. Indeed, a large part of the work done at IRRI and in the NARS since the release of IR8 has been on introducing host-plant resistance to many of the major insects and diseases attacking rice. Such a strategy reduces the use of chemicals and thus helps ensure the sustainability of rice-farming. An important reason to continue work on varietal improvement is the considerable untapped potential in the rainfed lowlands, where yield increases can still take place without unduly straining the resources of the soil and the environment.

Classical plant breeding methods will continue to be used in germplasm improvement and will still have a major role. The rice research community is, however, seeing its horizon expand enormously by some of the new methods from biotechnology. The centre for much of this work still remains in the industrialised countries. Although interest has increased with the discovery that rice is the most amenable among the cereals to biotechnological manipulation, scientists in industrialised countries otherwise have little reason to place rice as their top research priority. This makes it incumbent on IRRI and NARS to acquire and keep abreast of this new and valuable research tool, and to put it to use on the myriads of problems that afflict the still impoverished rice farmer.

Rice in unfavourable environments

Scientists have contributed a great deal to the welfare of the rice farmer, but their natural inclination has been to tackle the more soluble problems first, and leaving the less soluble ones until later. This means that work on areas with intractable problems tends to remain forever on the shelf. The rice research community has therefore to force itself, against its inclination, to look into the problems of the less favourable areas, both in the rainfed lowlands and in the uplands. This is where the poorest of the rice farmers live. In some ways their livelihood has been threatened by advances made in the irrigated areas, and they have been forced to migrate to irrigated areas or to other occupations. Although this is a normal working out of the market mechanism, for those affected it is not an attractive solution. Ways of helping them

maintain their options in rice-farming need to be found, even if it means diverting some resources away from research on some of the easier problems.

Global climate change

A final problem has arisen from growing concerns with global climate change. Partly responsible for the phenomenon is the alleged emission of greenhouse gases from rice paddies. Despite the estimates that are now freely floating around, there is little scientific measurement of the emission levels. The rice research community will have to be engaged in this task, first to measure the extent of the emission and then perhaps to see the consequences of the change on rice-growing environments.

1.5 IRRI in the Rice Research Community

The task ahead for the rice research community is large. How can that task be shared among IRRI, the other CGIAR centres and the NARS? The current organization of rice research in the CGIAR system is described in Appendix VI. This section focuses on the relationship between IRRI and NARS.

Currently many of the larger Asian NARS are capable of undertaking a much wider variety of tasks than before. The work on varietal improvements by classical methods, for example, is now being done increasingly effectively by the NARS, particularly for the irrigated areas. In doing this, the NARS will continue to depend on one crucial input from IRRI, namely its pre-breeding and development of new and novel parental sources; together with the associated International Network for Genetic Evaluation of Rice (INGER).

As the NARS have continued to improve the varieties, IRRI has appropriately been reducing its role, and has increasingly confined its activities to the more fundamental questions (strategic research in CGIAR terminology). One example is the application of biotechnology to improve the germplasm. In this task, IRRI has begun to work directly and also collaboratively with laboratories in the industrialised countries that have capacity and are showing increasing interest in working on rice.

Another example of a move toward strategic research is the work on pests and diseases. IRRI's studies of the ecology of pests provide the bases for the deployment strategies for durable pest management.

Increasingly, the immediate beneficiary of IRRI's research will not be the farmer but the rice research community in the NARS. For IRRI's activities to bear fruit, capacity in the NARS has to keep pace. Here lies probably the most difficult of IRRI's challenges: how to help the NARS keep pace with the extremely rapid pace of scientific advance, particularly as the NARS are facing retrenchment at least as severe as IRRI itself.

CHAPTER 2 - TRANSFORMATION OF IRRI

2.1 Overview

From the outset IRRI has had the necessary flexibility and means to adjust to changing circumstances and needs. At no time in its 32-year history, however, has the Institute made changes of the magnitude undertaken in this review period, 1987-1992. Although the transformation, launched to accomplish the vision projected in its strategic plan *IRRI Toward 2000 and Beyond*, is not yet complete, fundamental changes in direction, structure, and style have been made; new approaches to research implementation are in use; and a restructured working environment has been established.

Forces contributing to the reoriented, refocused, and to some extent, reduced IRRI of today and tomorrow are many and varied. Critical among them are two. The first is global -- rising and appropriate concerns about equity, our natural resources, and the environment. For IRRI, this translates in part into the challenge of sustainability: through what kinds of production and resource use systems that can be sustained over time can the world achieve needed rates of growth in the output of rice farming systems? The second involves the availability of funding. Because of IRRI's excellent track record and the centrality of rice to the lives of so many millions of people, the Institute, prior to this review period, has enjoyed remarkable growth in financial support. With minor exceptions, planned budgets were met; funds arrived on time; and requests for special project funding were usually favourably received. Since the late 1980's (and prospectively in the years immediately ahead), IRRI has had to cope with financial uncertainty. Even reduced target budgets were sometimes not met. The climate at IRRI, as in other mature CGIAR Centres, therefore, is one of retrenchment rather than growth. Therefore, now more than ever before, IRRI needs to be as cost effective as possible with the capacity to make rapid adjustments while minimizing the negative impact of changes on its programmes, most of which are of necessity long-term in nature. Looking ahead, IRRI must be able to deal with much more complicated sets of interacting forces than in the first quarter century of its productive operation.

Discussion of the nature and magnitude of many of the changes involved in IRRI's transformation follows.

2.2 Evolution in Goals and Objectives

In its new statement of goals and objectives, IRRI's historical focus on farmers and production, while retained, is substantially broadened. Concerns for those who come after us, for consumers and for the less advantaged, are specifically recognized. As reformulated, IRRI's stated goal is to help "improve the well-being of present and future generations of rice farmers and consumers particularly those with low incomes." How? As before, by generating and disseminating rice-related knowledge and technology and helping to enhance national research systems. Such knowledge and technology, however, are to be carefully designed so as to be of short- and long-term environmental, social, and economic benefit. Thus, IRRI remains a one-commodity centre - but a commodity centre whose programmes are restructured and specifically oriented to rice ecosystems.

2.3 Refinements in Priorities and Strategies

At the programme level, IRRI's priorities as expressed in its new strategic and operating plans call for the Institute:

- to remain a global Centre for rice research;
- to continue to preserve the rice germplasm of the world and maintain a definitive collection of rice knowledge and documentation;
- to make all activities consistent with environmental enhancement and sustainability goals;
- to increase research, especially that conducted in a collaborative mode, on the less favourable ecosystems (thus of necessity, decentralizing some activities to off-campus locations);
- to seek new higher yield potentials in all ecosystems, and strive for a yield breakthrough;
- to do more strategic and less applied research in part by expanding collaboration with other advanced institutions;
- to shift from direct support of national research systems to far greater use of the collaborative mode (i.e. as partners in a global rice research system); and to retain its traditional geographic focus on Asia but not to limit its work to that region.

IRRI's new environmentally focused strategy arose from the Institute's and the world's rising concerns about such issues as land degradation, soil erosion, water shortages, and pollution - all of which were reinforced by the policy directions in which the CGIAR and TAC are moving.

2.4 Adjustments in Programme Structure and Balance

Historically, IRRI's research programme structure was dominated by the priorities established in the Centre's 13 relatively autonomous disciplinary departments. Research resources rested in these strong hands. The Director for research and training in reality was only in charge of training and had few flexible resources at his disposal. Programmes did not control resources but depended on the allocations made by Department Heads. This research structure did not lead to coherent, centre-wide priority setting or to easy organization of cross-disciplinary work. It more nearly approximated the disciplinary departmental model commonly employed in academic institutions with inter-departmental collaboration in programmes. Whatever its shortcomings, the model was supportive of productive science. Over time, it produced the stream of highly valuable outputs that established IRRI as a premier rice research institution. Especially noteworthy were programmes in genetic evaluation and utilization, soil and crop management, control and management of pests, constraints and consequences of new rice technology, and collaboration with national programmes. Some non-research activities were co-mingled with research at the departmental and programme levels. Other non-research programmes such as training and information, were lodged in separate departments.

IRRI's revised research structure starts with rice ecosystems rather than the historic departmental pattern. Historically, ecological differences were recognized in some programmes and projects. But the new structure forces cross-disciplinary teamwork oriented fully to four broad but specific ecosystems with a fifth to deal with cross-ecosystem issues. Beginning with the first year of operation under the revised structure the percentage distributions of total direct research expenditures, core plus complementary, across the five programmes is shown in Table 2.1.

Table 2.1 Percentage Allocation of Research Funds Across Ecosystem Programmes : 1990-1992

RICE PROGRAMME	1990 Actual %	1991 Actual %	1992 Estimated %	1993 Proposed %
Irrigated	30	39	40	43
Rainfed Lowland	15	14	18	16
Upland	10	9	10	9
Deepwater and tidal wetland	8	7	7	7
Cross-ecosystem	36	30	25	25
TOTAL*	100	100	100	100

* Some years do not add to 100 percent because of rounding.

This newly adopted ecological orientation, initially, was largely a reclassification of existing work. What put teeth into the new structure and forced the formation of interdisciplinary teams, however, was the installation of a matrix

management system and the requirement that projects be defined to respond to the needs of each specific rice ecosystem.

IRRI programmes not included in the above five were grouped together in the new structure under the heading of International Programmes. The proportional distributions of core plus complementary funds in the five international programmes 1990-1993 are shown in Table 2.2.

Table 2.2 Percentage Allocation of Funds Among International Programmes : 1990-1993

INTERNATIONAL PROGRAMME	1990 Actual %	1991 Actual %	1992 Estimated %	1993 Proposed %
Germplasm conservation/distribution	5	4	4	3
Information, knowledge exchanges	13	22	18	17
Networks	10	15	14	11
Training	23	26	28	25
Country and regional projects	49	33	36	44
TOTAL	100	100	100	100

In terms of 1992 dollars, IRRI's core expenditures declined from \$35 million in 1987 to \$30.2 million in 1992 while special project funding rose from \$11.9 million in 1987 to \$15.3 million in 1992.

In 1992 estimated expenditures in International Programmes is about \$12 million or 70 percent of the \$17 million outlay for Research Programmes. Complementary projects account for about 40 percent of the expenditures in International Programmes versus 15 percent in Research Programmes.

2.5 Changes in Organization and Management

While the above provides some indication of the nature and magnitude of IRRI's structural, programmatic and managerial changes, to see the whole picture, one needs to examine the Institute's overall organization in 1987 (Figure 2.1) and compare it with the one that exists today (Figure 2.2). Note that in 1987, IRRI had 13 disciplinary research departments and five global research services, each reporting to the DG. Today, there are eight disciplinary-based divisions (to be reduced to seven in the near future) and the five research ecosystem programmes whose heads and leaders report not to the DG but to the DDG Research.

In 1987, IRRI's senior administrative structure included posts of DG, Senior DDG, DDG plus four Directors - one for Research and Training with only the training programme reporting to him, one for Administration, one for Protocol and

Figure 2.1
IRRI Organizational Chart
May 1987

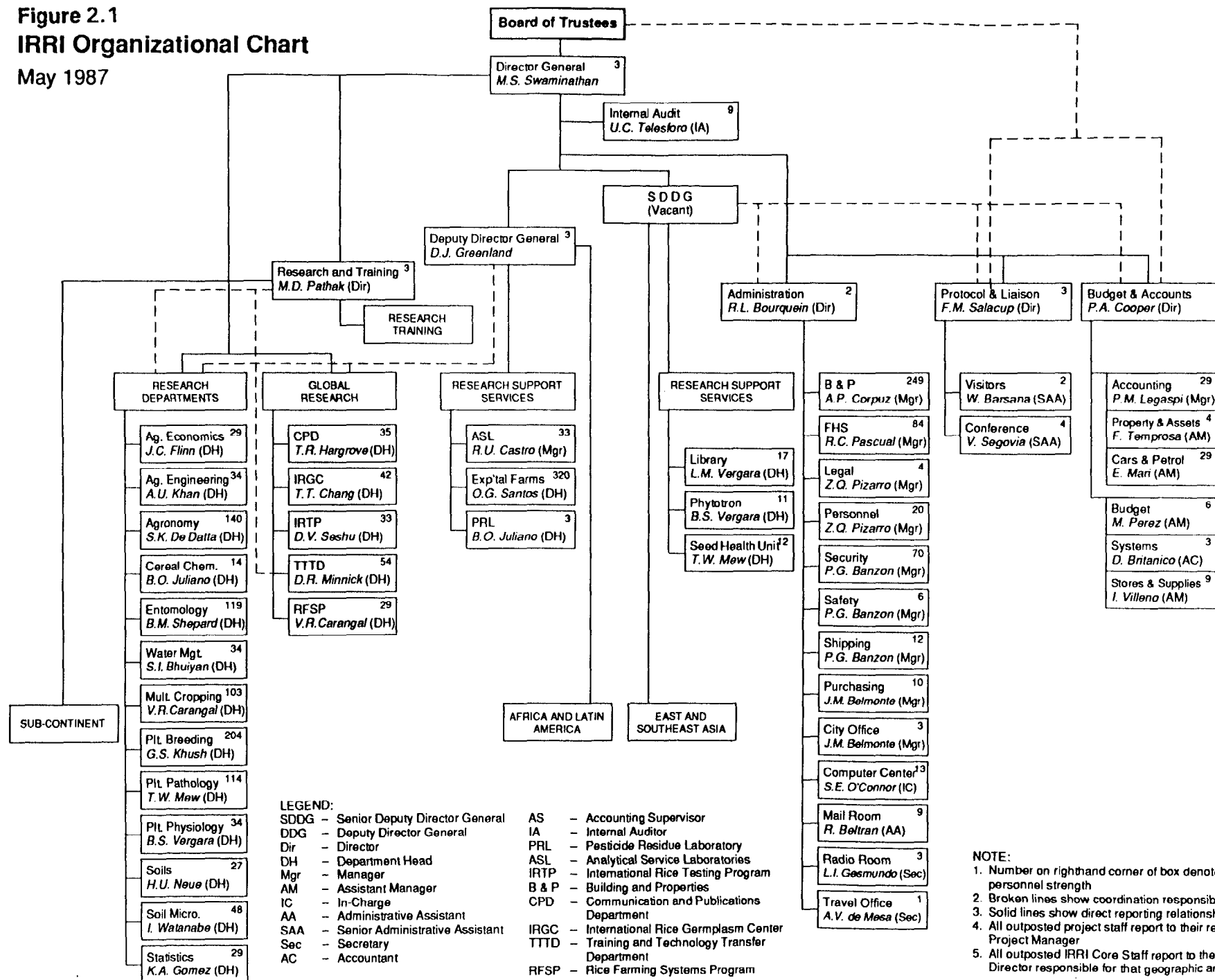
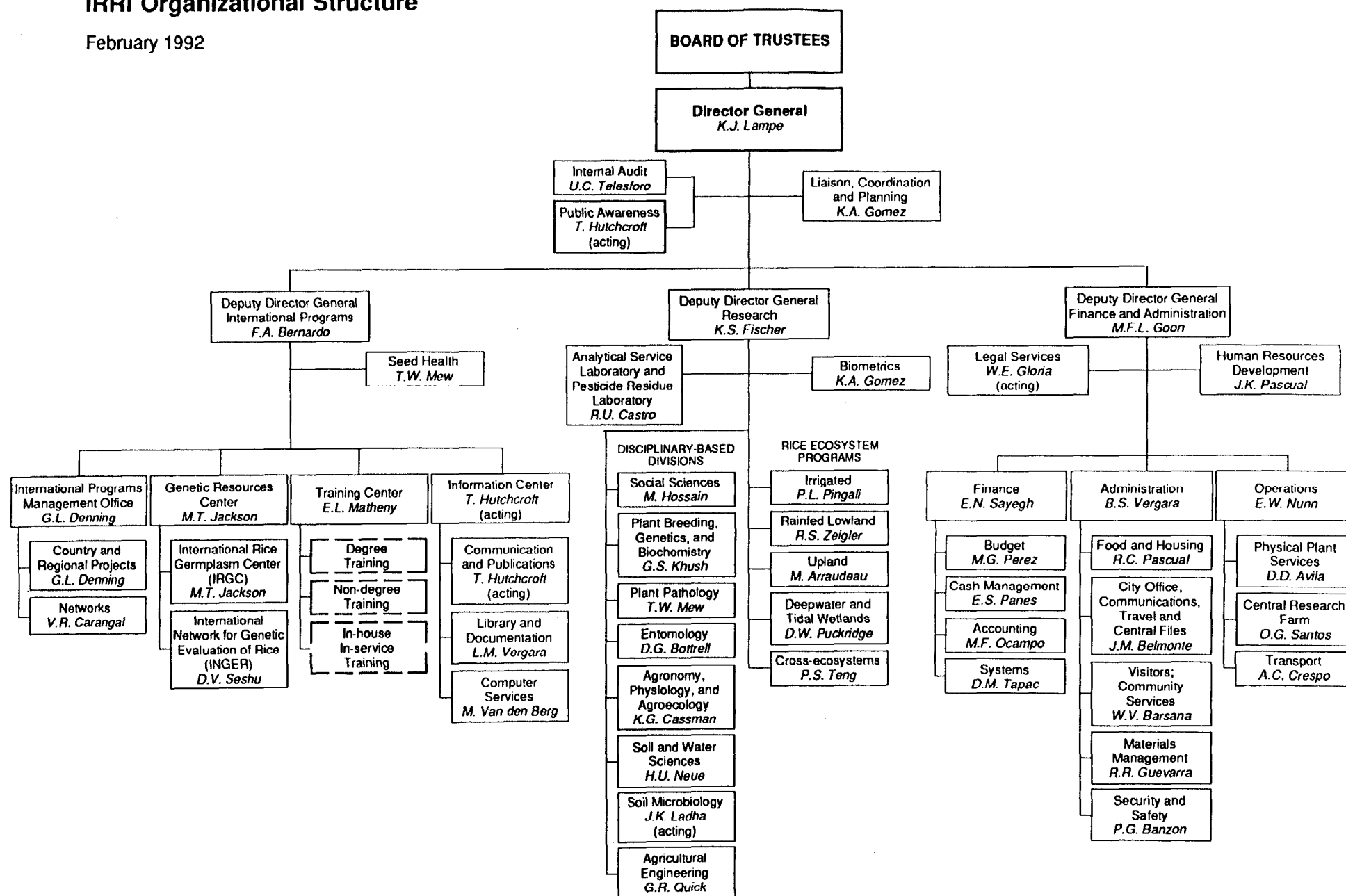


Figure 2.2
IRRI Organizational Structure

February 1992



Liaison, and the fourth for Budgets and Accounts. The two DDGs and the four Directors reported to the DG.

Today's senior management team constitutes a slightly larger but more specialized group than previously existed. In part, this much strengthened capability was installed in response to the 1987 External Programme and Management Reviews. IRRI's current senior directing staff consists of the DG, and his DDGs for International Programmes, for Research, and for Finance and Administration. Reporting to the latter are the Directors for Finance, for Administration, and for Operations. (The functions normally handled by a director of personnel or human resource development are shared among the DDG for Finance and Administration, the Director for Administration, and the head of the human resources office who works mostly with nationally recruited staff.)

It is noteworthy that only one of the seven director level posts is now occupied by a person who was at IRRI in May 1987. With few exceptions, the same is true for the division heads, programme leaders, and heads of centres. IRRI's changes in leadership have indeed been sweeping and all embracing.

At present, only the research programmes are managed under the matrix system. While matrix management is discussed in some depth in Chapter 4, it is useful to note that in research, the programme controls most of the funds with the flow being from programme leaders to project coordinators to scientists. In turn, the divisions provide disciplinary homes for the researchers, provide scientific leadership, and help promote the search for scientific excellence. In addition, they make available research support not obtained from the centralized services.

Not shown in Figure 2.2 are three important standing committees - steering, programme, and management - which have distinct terms of reference and meet at regular intervals. Critical to the functioning of the new structure is the Liaison, Coordination and Planning Unit which synthesizes information and expedites its flow, services the Board of Trustees, and in numerous other ways expedites the operation of the Institute by providing direct support to the DG.

2.6 Alignments in Staffing

One may grasp a further sense of the depth of the changes which have taken place in the last five years by noting:

- that in December 1987, IRRI had 72 internationally recruited staff (IRS), 62 on core and 10 on special project funds. In 1992 the numbers are 78, 60, and 18 respectively. Since January 1988, a total of 41 international staff have departed IRRI and 49 have been recruited;
- that the nationally recruited staff (NRS) has been materially downsized in both the researcher/manager and support categories. On the core budget as of 31 December 1987 to 31 July 1992, NRS

researchers/managers decreased from 615 to 502, a drop of 113. NRS support staff numbers dropped from 1,595 to 1,114, a decrease of 481. In the same period, special project funded NRS numbers decreased from 243 to 221 while those on temporary appointments declined from 295 to 221. 196 vacant core positions were also abolished. All told, IRRI's NRS was downsized by 886 positions. This leaner and tighter arrangement was made possible by the merger of departments into divisions and by centralizing and streamlining other operations. This staff reduction was done on a semi-voluntary semi-mandatory basis through of a special separation programme and by evaluating and abolishing expendable vacant positions;

- IRS appointments are now made on limited term contracts for periods of one to five years. Contracts renewed to extend beyond 10 years must be reported to the Board of Trustees. Previously, contracts were renewed annually but the automatic nature of the renewal process was such that, *de facto* staff tended to assume that they had continuous tenure.

2.7 Rehabilitation of Physical Plant and Research Farm

A master IRRI campus and physical plant plan was developed to establish areas or zones for research, for administrative support, and for public functions. An aggressive US\$15.6 million programme of rehabilitation, refurbishing and construction, funded largely by special capital project monies, is now well under way. Due to IRRI's age (now over 30 years) and the state of its facilities, such an extensive renewal programme was desperately needed for safety and for effectiveness of operations. An extraordinary effort was required by the DG and the directing staff to raise the funding needed to implement this campus-wide initiative as only US\$3.7 million could be made available from IRRI's core funds. The successful fund raising campaign produced the US\$11.9 million which was provided, over and above their regular CGIAR contributions, by 6 of IRRI's long-standing donors.⁴

The land area devoted to research plots at IRRI headquarters was substantially reduced, especially in the rainfed portion of the experimental farm. This was achieved in part through the increase in research work done away from headquarters for the less favourable ecosystems, in partnership with NARS, and in part through the efficiencies gained through consolidation into the Central Research Farm. This allows the Institute to establish a cropping system that includes a fallow period of about 25 percent.

⁴

The donors and the sums they provided in thousands of U.S. dollars were: Germany, 6,856; Japan, 2,871; Italy, 750; France, 710; Netherlands, 655; and Canada, 87.

2.8 Assessment

The foregoing is not a fully complete account of the transformations completed or under way at IRRI. Changes, in prospect and already made, permeate every facet of the institution's staff, programmes, facilities, and culture. To plan and implement so many changes so fast - while trying simultaneously to sustain programmes and output - induces stress on the part of management, staff, families, and the community at large. Much that was badly needed has now been accomplished. A great deal more is still in process. Stress and uncertainty induced by change can more easily be managed under conditions of growth than when retrenchment is necessary. IRRI has not had that luxury.

It is our view that to date, the following are among the key effects of IRRI's transformation:-

1. The research effort directed to improving the lot of the less advantaged producers and consumers in the poor resource areas has been systematized and intensified. While it is difficult to be precise, perhaps the shift of resources from work involving irrigated ecosystems to the other generally less favourable ecosystems is of the order of 20 to 25 percent. This has been done on grounds of equity considerations. It is fully recognized that returns per dollar of research expenditures are usually greater for work done in favourable ecosystems than in inherently unfavourable ones such as most of the rainfed areas. The rationale is straightforward. To help improve the lot of less advantaged producers and rural consumers, and the land resource base, researchers must work directly with the agroecosystems where such people predominate.

2. IRRI's ecosystem research orientation has been made explicit, is in use, and to varying degrees, multidisciplinary teams are now productively engaged. Programmatic planning, organization, monitoring and review have now gone beyond the stage where ongoing projects were simply shifted from one category to another.

3. Direct and indirect expenditures of effort on management have increased relative to those devoted to science. This has occurred for at least four reasons. The first is that the capacity of senior management has been increased. At the same time, the numbers of core IRS scientists has remained more or less the same while NRS numbers involved in research have declined. Given the situation that existed at IRRI five years ago, it was imperative that a much more effective financial, personnel, physical plant and scientific research management capability be installed. That has been done.

A second factor contributing to the increased administrative load is the effort required to respond to the growing requirements of the CGIAR and TAC, and to service IRRI's Board of Trustees. To execute its responsibilities properly, trustees have become much more demanding in the analyses, position papers, and services they require of staff.

The third reason for the relative increase in effort devoted to management and administration is the shift from single-scientist/single department-driven activities to interdisciplinary, ecosystem-based research. This has demanded very intense dialogue among scientists from different divisions. IRRI's efforts to enhance quality control (e.g. programme and peer reviews) have also added to the time spent on activities other than research.

A fourth reason is that IRRI's budget situation has required that activities be devoted to identifying, formulating, and seeking support for special projects, and to public awareness. Such activities often add more than their proportional share to the work load, especially that of administration.

4. For many of the reasons spelled out above, IRRI's programmatic output (research and education) understandably declined in the early part of the review period. Staff feel that now IRRI's curve of productivity and output is rising.

5. IRRI's new programmes and projects are largely in place. The scientific staff - both those who have been with the Institute for some time and those who are relatively new - are qualified and committed to meeting the challenges ahead.

6. IRRI's buildings, laboratories, farm and related facilities are being rehabilitated and refurbished to standards required for safe and effective operation.

IRRI received strong encouragement from concerned partners and stakeholders to make fundamental changes and to do so promptly. The recommendations made by the external reviews of 1987 were far reaching and demanding. They were endorsed by TAC and the CGIAR. IRRI, to the full credit of its management and Board, endorsed the body of the recommendations received and has implemented virtually all of them (Appendix VII). Although the results of the change process are not yet fully realized, much has been achieved and the good-faith efforts of all staff are clearly visible.

CHAPTER 3 - RESEARCH PROGRAMMES

3.1 Introduction and Overview

In 1990, IRRI reorganised its research on an ecosystem basis, firmly establishing an emerging theme of setting rice improvement within a wider context of both the crop environment and rice farming systems. The reorganisation also made explicit IRRI's concerns with growing poverty in disadvantaged areas as well as environmental issues such as soil degradation.

At the same time, greater emphasis was given to strategic rather than applied research, partly to fulfil the obligations of a CGIAR centre with global responsibilities and partly to acknowledge the emergence of stronger NARS. In this context IRRI has described its role under four headings:

- Supporting research underway in the national systems;
- Conducting research of supranational importance;
- Initiating work utilising newly available research tools to understand newly identified problems;
- Enhancing international research collaboration.

Adoption of an ecosystem strategy required changes in research focus, particularly for more effort in resource management, with all its complex multi-disciplinary demands, and for greater attention to the longer term issues of yield stability and sustainability.

Research is organised under five Programmes. Four represent major rice production ecosystems - Irrigated, Rainfed Lowland, Upland, and Deep Water and Tidal Wetlands. In each of these, interdisciplinary groups of scientists focus on problems specific to that ecosystem. The fifth Programme, Cross-Ecosystems, conducts research applicable across the different ecosystems or that is independent of an ecosystem focus (e.g., the development of basic techniques of analysis). A Programme Leader has major responsibility for guiding the planning of research in the Programme, including budgetary control.

Scientists, and other resources, are still located within disciplinary-based Divisions (equivalent to the previous Departments, now eight but soon to be consolidated to seven). Thus the Programmes and Divisions form a two-way research matrix in which, as some scientists describe it, "the Programmes decide WHAT research should be done,

and have the budget to pay for it, while the Divisions decide HOW the research should be done, and provide the scientific staff and resources to do it".

Most of the Programmes divide research efforts into Sub-programmes to indicate broad areas of study, but whether this division is made or not, all research is organised into Projects (Table 3.1). Each Project has a Project Coordinator who is one of the interdisciplinary team but may be from any appropriate discipline. There were 49 projects in 1990, and 31 in 1991, but these have been reduced to a total of 22 in 1992, ranging between two to eight per Programme. Scientists commonly refer to 'activities' within a Project, to indicate particular components (e.g., weed control, drought screening, etc). The inputs from different Divisions into each Project in terms of scientists' time are given in Table 3.2.

A further dimension has been added to the research with the concept of Research Consortia. These are aimed at "sharing responsibilities in rice research" and are implemented by "linking several NARS with IRRI to conduct jointly planned and agreed research agenda". The objective is to encourage strategic more than applied research. Only a few stronger NARS, who have the capacity for this kind of research and who can make a longer-term commitment to it, are members of a given consortium. Each NARS agrees to develop research on a particular topic (e.g., drought resistance, land and water management) on an appropriate 'key site'. IRRI makes a similar commitment. There are some central funds for workshops and training and limited funds available to each member for research activities, research supplies, local travel and minor equipment. NARS are encouraged to carry out some strategic research of value to themselves and other consortium members, but for which they normally would lack the opportunity or resources to undertake. To date, two consortia have been established, Rainfed Lowland and Upland.

IRRI has increased its emphasis on 'research networks' in which knowledge on a specific research topic (e.g., systems simulation methodology as in the SARP network) is generated and shared between institutions in both developing and industrialised countries by means of symposia, workshops or training. IRRI distinguishes between consortia and research networks on the basis of membership; consortia are restricted to invited peer institutions, while research network membership is open to all.

The following sections comment on the research in each Programme and from the perspective of the disciplinary-based Divisions. Comments are also made on the research support services and the overall management of the research. Finally, an assessment is presented.

IRRI has a 'pipeline' of emerging results. For the first three years of the five-year period covered by this review, research was carried out in the former disciplinary Departments. However, for the last two years research has been carried out within Programmes and Projects. Therefore, reports of progress for the entire five years are not easy to reconcile. Our comments on the overall research program attempt to cover important parts of the research, but we emphasise only a part, and we have attempted to comment in the context of the new Programme structure, including therein

Table 3.1 IRRI Projects by Research Programmes, as of September 1992

No.	Project code	Sub-Programme/Project Title
	<u>Irrigated Rice</u>	
1	IR92-1-1	<i>Germplasm Improvement</i> Integrated germplasm improvement
2	IR92-1-2	Hybrid rice
3	IR92-2-1	<i>Crop, Resource and Pest Management</i> Crop establishment and water and tillage management
4	IR92-2-2	Pest ecology and IPM technology development
5	IR92-3-1	<i>Production, Environment and Livelihood Impact</i> Indices of sustainability and productivity
6	IR92-3-2	Rice-wheat systems
7	IR92-3-3	Global climate change
8	IR92-3-4	Rice grain, seed quality, post harvest and biomass issues
	<u>Rainfed Lowland Rice</u>	
9	RL92-1-1	<i>Sustainable Resource Management</i> Resource management for enhanced production
10	RL92-1-2	Integrated nutrient management
11	RL92-2-1	<i>Germplasm Improvement</i> Genetics, physiology, and breeding
	<u>Upland Rice</u>	
12	UR92-1-1	<i>Sustainable Land and Resource Management</i> Sustainable land and resource management
13	UR92-2-1	<i>Germplasm Improvement and Crop Management</i> Germplasm improvement and crop management
	<u>Deepwater and Tidal Wetlands Rice</u>	
14	DT92-1-1	<i>Increased Productivity and Land Use Efficiency of Deepwater Ricelands</i> Improved deepwater rice germplasm
15	DT92-1-2	Crop and resource management for deepwater rice
16	DT92-1-3	Integrated pest management for deepwater rice
17	DT92-2-1	<i>Improved Productivity and Sustainability of Tidal Wetlands Rice</i> Improved germplasm and management for tidal wetland rice
	<u>Cross-ecosystems Research</u>	
18	CE92-1-1	<i>Germplasm Evaluation and Genome Manipulation</i> Genetic characterisation of conserved germplasm
19	CE92-1-2	Genome manipulation
20	CE92-2-1	<i>Crop Ecology and Pest Science</i> Systems analysis and modeling of rice production systems
21	CE92-2-2	Pest science and management
22	CE92-3-1	<i>Environmental Characterisation, Impact Analysis and Research Prioritisation</i> Environmental characterisation, impact analysis and research prioritisation

Table 3.2 Staff Allocation by Division and Programme - Estimate for 1993

RESEARCH PROGRAMMES																																				
Division/Centre	Irrigated Rice					Rainfed Lowlands					Upland Rice					Deepwater and Tidal Wetlands					Cross Ecosystems					Total Research Programmes										
	IRS			Sub-	NRS	IRS			Sub-	NRS	IRS			Sub-	NRS	IRS			Sub-	NRS	IRS			Sub-	NRS	IRS			Sub-	NRS						
	Core	Comp	VS	PD	Total	Core	Comp	VS	PD	Total	Core	Comp	VS	PD	Total	Core	Comp	VS	PD	Total	Core	Comp	VS	PD	Total	Core	Comp	VS	PD	Total						
Social Sciences	0.90		0.50		1.40	16.65	0.90		0.50	1.00	2.40	4.20	0.80			0.80	9.85	0.30			0.30	1.95	1.00			1.00	14.45	3.90		1.00	1.00	5.90	47.10			
Plant Breeding, Genetics & Biochemistry	2.90		1.00	0.17	4.07	53.30	1.10			1.10	8.90		1.00	3.00	4.00	9.60	0.80			0.80	14.25	4.20		0.90	1.24	6.34	33.05	9.00		2.90	4.41	18.31	119.00			
Plant Pathology	1.15		0.50	1.62	3.27	25.25	0.75			0.75		0.55	0.80	1.15	13.15			0.15		0.15		2.50		1.75	2.83	7.08	42.60	4.95		3.00	4.45	12.40	61.00			
Entomology	1.35			1.00	2.35	29.58	0.20			0.20	1.75					0.30	0.10			0.10	1.95	1.35			2.34	3.69	32.42	3.00			3.34	6.34	66.00			
Agronomy Physiology & Agroecology	2.75	0.05	0.50	0.71	4.01	47.85	2.35	0.25	1.15	0.39	4.14	65.80	2.50	0.20	0.20	2.90	33.05	1.05	0.05		1.75	2.85	11.50	1.20	0.40	1.15	1.00	3.76	16.80	9.85	0.95	3.00	3.85	17.65	175.00	
Soil & Water Sciences	1.50	1.00			2.50	20.00	0.90			0.50	1.40	12.60	0.20			0.20	1.40	0.60			0.60	8.10	0.80			0.80	4.60	4.00	1.00		0.50	5.50	46.70			
Soil Microbiology	0.30				0.30	1.90	1.60			1.00	2.60	28.90	0.10			0.10	1.20												2.00			1.00	3.00	32.00		
Agricultural Engineering	0.85	1.00		1.00	2.85	31.07	0.15				0.15	3.75				2.88												5.30	1.00	1.00		1.00	3.00	43.00		
Research Support							0.10				0.10																		0.10				0.10			
Genetic Resources Centre																						0.65			0.65	1.40	0.65					0.65	1.40			
Seedhealth Unit																																				
Information Centre																						0.10			0.10	0.30	0.10					0.10	0.30			
Network Coordination	0.20	1.00			1.20	1.15	0.10				0.10	1.05																0.30	1.00			1.30	2.20			
Training Centre																																				
Country Regional Projects							0.20				0.20		0.30			0.30												0.50				0.50				
Total	11.90	13.05	2.60	4.50	21.95	226.75	8.35	0.25	1.65	2.89	13.14	126.95	4.45	0.20	1.80	3.00	9.45	71.33	2.85	0.05	0.15	1.75	4.80	37.75	11.80	0.40	3.80	7.41	23.41	160.92	39.35	3.95	19.90	19.55	72.75	613.70

research results from the former Departments. We realize this approach may not do justice to the research efforts of the Departments, but we decided not to discuss the research of the period reviewed in a bifurcated way involving both Departments and Programmes.

3.2 Irrigated Rice Ecosystem Programme

3.2.1 Evolution and Current Focus

IRRI defines irrigated rice as follows: Irrigated rice is grown in banded fields with assured irrigation for one or more crops a year; some areas are served by irrigation only in the wet season.

Irrigated rice covers 53 percent of the world's ricelands, and accounts for 73 percent of production. This ecosystem, although diverse, has been sustainable since ancient times, and now plays a significant role in providing low-cost rice to large and growing populations.

Over the years, IRRI made its greatest contributions in irrigated rice, and today it is this ecosystem that presents IRRI with perhaps its greatest challenge. With the closing of the land frontier in most parts of the world, but particularly in Asia, intensification of agriculture has become imperative. Probably nowhere has intensification been higher than in irrigated rice; where one crop per year was the norm in many places, double and even triple cropping of rice is now common, or double or triple cropping with other cereals (e.g., wheat, maize), vegetables or other crops. Such intensification places unprecedented pressures on land and water resources, with so-far unknown future consequences. Declining soil fertility, nutrient imbalances in soils, water shortages, declining water quality and many other problems threaten rice and food supplies for huge populations in Asia.

Along with the emerging problems of intensification mentioned, there are troubling signs of declining or stagnating yields on the IRRI Experimental Farm and at other experimental sites in Asia. In some places, high-producing farmers also are experiencing declining or stagnating yields, or, in some cases, decreasing factor productivity of inputs such as fertilizers. The yield decline problem is serious, and worrying, and requires strategic research to understand its nature and complexity. IRRI is uniquely placed to energize and lead an international effort on yield stagnation and decline in irrigated rice. This is perhaps the greatest sustainability issue facing IRRI today.

A related problem that needs solution is improving the yield potential of rice in general, but in irrigated rice in particular. The early high-yielding semi-dwarf varieties such as IR8 and its successors provided a new paradigm for yield improvement in tropical rice. Succeeding varieties were improved by incorporating ever-increasing multiple resistance to pests and diseases, along with increased tolerance to abiotic stresses as well as by shortening the growth duration. However, the yield potential of tropical rice has not improved much above that of IR8. A new generation of rices is

needed that can yield even higher, with the additional benefits of even greater levels of resistance to pests and diseases and tolerance of stresses. Hybrid rice is expected to raise yield potentials from 15-25 percent or more. IRRI considers 10 t/ha to be the present yield ceiling for tropical irrigated rice. It should be noted that both Japan and China have initiated super-high yield projects in japonica rice; the Panel was told the Japanese effort aims to increase yields by 50 percent. IRRI has properly embarked on a new effort to raise yield potential in tropical rice.

A third related problem, and one that is even more future-oriented, is the threat, at least in the minds of some, of global climate change. Here too rice figures prominently, in that flooded rice, and irrigated rice in particular, is blamed for methane emissions that may contribute to global warming. IRRI is uniquely placed to conduct research on both the negative and positive consequences of warming and other changes that may take place, including the effects of such change on pests of rice and other conditions in the rice-growing environment.

With that brief discussion of the changing environment for rice science, we turn to the Programme itself.

The Irrigated Rice Programme is the largest of the single ecosystem programmes, comprising 40 percent of the research effort in 1992 and projected to comprise 43 percent of that effort in 1993.

Programme objectives include raising yield potential from 10-11 t/ha to 15 t/ha within the coming 20 years, understanding and reversing the yield decline, developing crop and resource management techniques to improve input efficiencies, securing yield gains, and reducing the gap between potential and actual yields.

Research activities are carried out under three sub-programmes and eight projects (Table 3.1).

3.2.2 Achievements and Impacts

Germplasm Improvement Sub-programme

To attain the priority objective of raising yield level significantly, a new plant type was designed and described in the Strategic Plan. The prototype has already been developed by hybridizing tropical japonica rices having large panicles, sturdier stems, reduced number of tillers and thick dark green leaves with short statured donors. Genes for resistance to biotic and abiotic stresses are being incorporated. Evaluation of the new lines for yield potential will start in 1994.

Rice varieties have been found which can be used as parents for developing genotypes for direct seeding in puddled flooded soil. Several new lines with aroma and multiple resistance to diseases and insects have been developed. Resistance to major diseases has been incorporated into elite germplasm. Most elite lines have multiple resistance to blast, bacterial blight, grassy stunt and, recently, resistance to tungro. Of more than one thousand breeding lines screened for low temperature, 21 had reasonable

tolerance. New genes for resistance to bacterial blight, brown planthopper and tungro were incorporated into improved germplasm. Two germplasm lines were found to have some level of resistance to sheath blight.

IR68 and IR70 demonstrate remarkable utilisation efficiency for phosphorus and zinc, indicating these varieties may be used with no or minimal applications of these nutrients under moderate soil stress. Bulk populations and lines were developed for evaluation and selection on saline-alkaline ricelands of India and Pakistan. Though many salt-tolerant varieties were used to develop these materials, only crosses with two traditional varieties produced materials with high adaptability to these difficult soils.

An IRRI hybrid rice outyielded the best inbred by 11 percent in the 1990 and 1991 dry seasons. The frequency of restorer lines among elite lines developed for irrigated and rainfed conditions was high (65-76 percent), indicating there is no shortage of suitable restorer lines for developing hybrids. Attempts are being made to adapt a Chinese hybrid seed production system for the tropics. Estimated hybrid seed production costs in the Philippines range from US\$750-1000 per ha, with gibberellic acid being the most expensive component (US\$250-300/ha). Collaborative research on hybrid rice has been established with India, Indonesia, Malaysia, Republic of Korea, Philippines, Vietnam, Egypt and Japan.

Crop, Resource, and Pest Management Sub-programme

Since 1968, intensified rice cropping (three crops per year) in a long-term experiment at IRRI Farm has shown a linear yield decline of 35-40 percent; the Programme is trying to identify the factors responsible. Similar results have been observed in research sites at Nueva Ecija in the Philippines and Hyderabad in India, and, to assure sustainable production, it is essential to elucidate the causes of the problem.

Rice plant responses to possible changes in global climate, especially to elevated UV radiation, indicated as much as 20 percent stunting of seedlings, reductions in leaf area of as much as 30 percent, and decreased stomatal size and density in the most sensitive cultivars. Of more than 100 cultivars screened, differences in sensitivity to UV were found in both indica and japonica cultivars. Some of the less sensitive cultivars were native to high altitude areas.

The CERES-RICE model was used to predict ammonia volatilization from paddy fields. A model of water chemistry governing ammonia volatilization was developed. Cropping intensity and soil management during the dry-wet transition period can influence losses of soil N as well as N fertilizer requirements. Research was completed on the N potential of azolla as a green manure for rice, and azolla strains were improved through hybridization. The blue-green algae program was also completed; it was concluded there was limited potential for algal inoculation in intensive rice cultivation. Field methods were established to screen rice varieties for high biological nitrogen fixation-supporting ability.

Multiple-split applications of N fertilizer at tillering and flowering resulted in higher yields, thought to be due to improving the physiological condition of flag leaves. Highest yields were obtained when one-half of N was applied basally and the other half was split into three and applied at later stages of growth. Yield advantages of multiple split applications were more than one t/ha over all basal or two split applications. For flooded, row-seeded rice, low tillering cultivars and multiple split N applications appear most suitable. Grain yields increase significantly with timing but not with rate of N application. Doubling N rate within the same application timing did not further increase grain yield. However, yields increased when N applications were delayed within the same overall N rate.

To save labour in harvesting, three types of machines - stripper gatherer, stripper thresher, and stripper combine - were designed for a range of geographical and socioeconomic conditions. A twin-furrow, animal-drawn mouldboard plough, with twice the capacity of the traditional plough and yet with very little increase in draft requirement, was developed. Two small, lightweight hydrotillers were developed for small land parcels or terraces. In water management, interceptor/drainage channels constructed on rice farms with very high water tables, and connected to existing drains systems, lowered water tables and enabled high yields of maize (ave. 7.3 t/ha). For every centimetre of water table lowered, an additional 0.35 t/ha of maize was produced.

IRRI has intensified its work on direct seeding, following indications that some farmers may be shifting away from transplanting to direct seeding. Returns to farmers practising direct seeding are some US\$100/ha higher than with transplanting. Seedling establishment is highest in saturated soils, but decreases with increasing water depth. Direct wet-seeded rice was found to produce higher yields under conditions of mild water shortage during the dry season.

Yield analyses confirmed grain yields were always higher during the dry season than the wet season due to more favourable climate, higher solar radiation and lower incidence of pests and diseases. Lodging contributed to lower yields during the wet season. The late wet season has higher rat and bird damage and spikelet sterility.

To study better the tungro virus, GIS and historical information from the Philippines Department of Agriculture were used to plot the occurrence of the disease and to select a 'hot spot' pilot site where the disease can be epidemic. Larval parasitoids slow the exponential growth of leafhopper populations and play an important role in regulating the abundance of the pest. A biocontrol agent for Bakanae disease and sheath blight was identified, and studies are underway to find ways to use it in IPM. Bakanae can be controlled by chemical seed treatment and use of resistant cultivars. In studies of 15 farmers who managed their own insecticide-treated (and untreated) plots in Nueva Ecija, yield loss from insects was 7 percent or 0.3 t/ha per crop over three cropping seasons. Farmers could not prevent this yield loss with insecticides. An improved 'active barrier' system using low-cost plastic fencing for controlling rats at IRRI may prove cost effective for farmers.

Production, Environment and Livelihood Impact Sub-programme

Studies of draft power showed the greater importance of land preparation and turnaround time in irrigated systems than rainfed systems. Diversification was most rewarding to farmers in partially irrigated areas. Only the rice-mung bean rotation was advantageous in fully irrigated systems. Short duration green manure legumes between the wet and dry seasons appeared cost-effective in partially irrigated but not in fully irrigated systems. A rice-maize rotation has replaced the standard rice-rice system on many farms that have access to irrigation in the dry season.

Global climate change activities included: identifying plant traits that confer or indicate UV tolerance, developing a field facility for research on UV-B exposure, initial laboratory studies on effects of UV-B on blast, modifying the Phytotron for CO₂ monitoring and control, and planning for plant modelling with SARP network teams.

Studies were conducted of the acute human health effects of pesticides on pesticide users. Depressed cholinesterase levels, cardiovascular abnormalities, and lower haemoglobin levels were the main findings of the study. A study on impact of pesticides on farm productivity and human health indicated the net impact of pesticides is negative when health effects are accounted for. A tax on pesticides can lead to reduced pesticide use and improved health.

A study of agrochemical use and its effects on ricefield biology showed that N fertilizer had greater effects than pesticides. Pesticide application had no marked effect on soil microbial biomass, blue-green algae populations, and zooplankton. Field monitoring was completed on pesticide residues in well water, vertebrates, rice and micro-fauna in the Laguna (Philippines) area. Simulated experiments were used to understand better the environmental effects of pesticides.

Broadcasting nitrogen inhibited the growth of N-fixing blue green algae, but agrochemical use did not markedly reduce primary production in floodwater. Because it favoured arthropods which consumed the algae, N application also favoured nutrient recycling. Deep placement of fertilizers markedly reduced mosquito larvae in the floodwater.

3.2.3 Assessment

The Irrigated Rice Programme is large and complex. Its work covers a wide range of activities that relate to the different Sub-Programmes and Projects. Staff members are capable and dedicated but find themselves stretched very thin, especially during this period of change. There is need in the Programme for more disciplinary help in insect host-plant resistance, a position that we note is being recruited actively.

As stated before, this Programme faces two major research problems, raising yield potential and yield stagnation and decline.

IRRI appears to be well along in developing a new plant type with reduced but more effective tillering and with higher yield potential. We were impressed with this work and look forward to further efforts by the Institute to increase selections of the new plant type for assessment in different environments and cultivation systems, comparison of its yielding ability with hybrid rice, and the possibility of its use in hybrid rice production.

The work on hybrid rice appears to be progressing well. IRRI hybrids compete well in yield trials with elite cultivars, seed production problems and prospects appear to be understood better, and there is growing interest in hybrid rice in a number of Asian countries. Hybrid rice appears to be a promising companion strategy to the improved plant type in IRRI's efforts to raise yield potential in tropical rice.

IRRI has now reached the stage when it can capitalize on its research on developing hybrid rice using cytoplasmic male sterility (CMS). However, the difficulties in using CMS in most countries have become evident, and the use of genic male sterility responsive to temperatures (TGMS) and/or photoperiodic changes (PGMS) appears promising. To ensure future development of this system for hybrid rice, IRRI should put more effort on producing appropriate TGMS lines adapted to tropical climates.

The evidence that yield stagnation or decline seem to be occurring in at least some intensively-managed production systems in parts of Asia is very troubling. Also troubling is the apparent decrease in factor productivity in some wheat and rice production systems.

One reason given for declining yields under intensive cropping is that continuous cropping may reduce the efficiency of N fertilizers. In the temperate region, drying paddy soil is known to be effective for releasing soil-fixed N and keeping land productive. Agronomic and cost benefit studies of short fallow periods of drying of soil, or growing upland crops, might be needed. In an examination of soil organic matter and N release at IRRI, it appears N release is smaller than would be expected. In some studies done in collaboration with the Natural Resources Institute in the United Kingdom, NRI scientists have concluded that biomass activity under persistent anaerobic conditions of intensive flooded systems is quite different from that of less intensive systems, and one result is the low release of N.

There are likely to be many factors for stagnating or declining yields of intensively-managed ricelands in Asia. Nutrient shortages and imbalances, soil chemical and physical changes, increases in biotic or abiotic stresses, all could be involved. The problem is enormous and, while IRRI needs to be in a leading position in the work, it cannot handle the job alone. A global effort is needed to find the best minds possible in soil science, plant pathology and entomology, water management and the other disciplines required. The threat of declining yields and decreasing factor productivity in the great ricebowls is one of the greatest sustainability issues which the world faces. Certainly it is the greatest sustainability challenge facing IRRI. The Panel wishes to bring this need to the attention of the global community and urges that donors and the global community should respond to make this an agricultural 'man-on-the-moon' project for the remainder of this century. The resources needed will be significant,

perhaps in the order of US\$50 million over 10 years. This is roughly the scale of the current Rockefeller Foundation effort in biotechnology, and is modest in comparison to many other matters in which the world community joins to address. What is needed is commitment of minds, research resources and the necessary funding.

Recommendation 3.1

The Panel, recognizing the threat posed to food supplies by yield decline and decreasing factor productivity in intensively managed ricelands, recommends that IRRI lead a major research effort, enlisting the best talents available in the world to seek solutions for this complex of problems, a task that may require a decade or longer to complete.

3.3 Rainfed Lowland Rice Ecosystem Programme

3.3.1 Evolution and Current Focus

Rainfed lowland areas often receive enough rainfall to grow rice plus an additional crop. However, yields are low and unstable due to a multiplicity of factors including erratic and unpredictable rainfall causing floods and droughts and a range of pest, disease and soil-related constraints. Also, adoption of modern cultivars and improved production technologies has been minimal.

In the past, IRRI has been urged to do more on problems of less favourable rice environments. The second and third external reviews recommended a substantial shift in efforts in that direction. In 1987, the projected benefits from research in various rice environments estimated by the first Strategic Planning Committee were: 58 percent from irrigated; 27 percent from rainfed shallow; 10 percent from deepwater and tidal wetlands and only 4 percent from the upland ecosystems. Commenting on the first draft of IRRI's Strategic plan, the Board of Trustees in 1987 observed "the board hopes to see more of research in these adverse environments conducted off-shore in collaborative projects with appropriate national systems and based on carefully selected widely representative sites": also, "Better knowledge and characterization of various environments and sites will be crucial to the wider impact of the approach. The Board gives high priority to research of this kind within the context of rice-based farming systems". With the adoption of the Strategic Plan in 1989, IRRI is now fully committed to research in these environments.

Current research is focused on increased productivity and yield stability in less favourable rainfed lowland environments. Mechanisms governing the plant's adaptation to predominant stresses, the processes and dynamics of water and nutrients, and the interaction of plants and the environment are emphasized. Genetic improvement aims at developing higher yielding lines and more stable yields under conditions of variable submergence and drought. Management strategies include: improved stand establishment, weed management, efficient and integrated nutrient management, and on-farm rainwater management. A welcome development is the consortium approach, in which IRRI and several national systems agree on a

coordinated research effort to understand better both ecosystem characteristics and indigenous knowledge. All these efforts aim to develop the basis for intensive rice-based cropping systems.

3.3.2 Achievements and Impact

Germplasm Improvement Sub-Programme

The major objective is to develop rice lines with tolerance for submergence and drought and capable of high, reliable and sustainable yields for different environments. Early generation and advanced breeding lines were screened for resistance to drought, submergence, disease and insect pests, and grain quality traits, and several lines with desirable characters were identified. Some of these were evaluated in the International Rainfed Lowland Observational Nursery (IRLON) and performed well at many sites. The gene governing photoperiod sensitivity was tagged using molecular techniques and can be used in breeding for higher yield potential. Similarly, submergence tolerance has been transferred from traditional to modern lines with multiple disease and insect resistance. The near-term aim is to develop a plant type with intermediate stature and tillering ability, and a vigorous root system that will respond to favourable fertilizer regimes, yet still tolerate stresses. Medium range research efforts aim to combine photoperiod sensitivity, drought and submergence tolerance, and pest and disease resistance.

Resource Management and Integrated Nutrient-Management Sub-Programmes

Dry seeding in drought-prone lowlands has high potential for increasing productivity particularly of water, in terms of rice yield and cropping intensity. In highly permeable soils, reducing water losses by installing polyethylene sheet barriers is being explored. A major effort is underway to understand nitrogen dynamics in the rice-fallow/legume cropping systems and to improve strategies for minimizing nutrient losses. The potential of green manure crops to produce nitrogen for rice-based cropping systems is being explored. These and other studies aim to improve productivity of the rainfed lowlands.

IRRI participates in the Rainfed Lowland Consortium at two levels:

1. As a member institution with key site research responsibilities, IRRI is addressing the issues of drought, weeds, and flash floods at vegetative, reproductive, and maturation stages in the Tarlac key site in the Philippines. Activities include site characterization (biophysical and socio-economic) and analysis soil moisture, soil and plant nutrient status, and weed population dynamics. Results will serve to develop and calibrate models of plant performance under moisture stress (deficit and excess).

IRRI research contributions as a Consortium member also include developing application of Geographical Information System (GIS) and remote sensing to characterize the ecosystem variability and heterogeneity in order to quantify risk and develop extrapolation domains for technology.

2. Research support and coordination. IRRI Rainfed Lowland Program scientists serve as resource scientists for the other Consortium sites. Responsibilities include providing strong disciplinary support for key sites research as well as research planning, interpretation and reporting of results. IRRI is responsible on behalf of the Consortium for financial and technical reporting to the donor.

3.3.3 Assessment

The Panel approves of the new approach and the objectives selected. These appear realistic and achievable, provided the research management foresees and removes impediments, logistical or technical, and ensures plans are carried out without sacrificing scientific rigour. To ensure success and lasting impact, enlisting the full commitment of the collaborating agencies is essential. Our limited interaction with the scientists raised matters of concern for success including; communication/decision-making channels for IRRI's out-posted staff in general, lack of needed inputs from social science, and the need for inputs on rain water management strategies. The Panel is worried that if these limitations are not dealt with expeditiously, the programme sites might become just additional places for testing germplasm. Notwithstanding these words of caution, the Panel reiterates that this can be an exemplary collaborative programme, from which both IRRI and the NARS will benefit.

3.4 Upland Rice Ecosystem Programme

3.4.1 Evolution and Current Focus

Upland rice research began at IRRI in the 1960s. The Upland Rice Ecosystem Programme has as its objective the rehabilitation and increased stability and sustainability of upland rice farming systems. Since its inception in 1989 the Programme has grouped its research in two Sub-programmes, each with a single Project (Table 3.1).

Research in 1989 covered a range of activities at locations in the Philippines and a diagnostic survey in Lao PDR. Because of the extreme diversity of the upland systems and the need to broaden studies to other representative types ('sub-ecosystems') the research has expanded to other locations: multi-disciplinary activities in India, Philippines, Indonesia and Thailand; breeding collaboration in China and Myanmar; and diagnostic surveys in Myanmar, Madagascar, Indonesia and Thailand. The programme has worked closely with national systems.

3.4.2 Achievements and Impact

Sustainable Land and Resource Management Sub-Programme

Major emphasis has been given to identifying the physical, biological and social factors determining productivity. A diagnostic survey in the Philippines examined the reasons for farmers' varietal preferences, tillage practices, associated weed problems and returns to different farming strategies. In collaboration with the national system, a survey during 1989 and 1990 in the slash and burn systems of Lao PDR found that

weeding accounted for 45-60 percent of labour inputs and that, although farmers recognised declining fertility as an associated factor, they considered weeds the major reason for declining yields with successive years of cropping. A survey in Eastern India identified drought as the major constraint in that area, due to erratic rainfall, run-off, low water-holding capacity of soils, inadequate groundwater and competition for weeds. Similar studies in Indonesia have shown that farmers rank their problems as wild pigs, soil fertility and weeds, but emphasised the need for a better understanding of farmers' crop and soil management practices.

Weeding can be reduced by introducing a cowpea intercrop, but increasing crop intensification by growing maize after rice may contribute to increasing weed problems and lower yields. Improving the productivity and sustainability of upland rice systems by introducing legumes as intercrops, relay or sequential crops has been extensively examined in the Philippines and India. Farmer-managed cropping systems trials in one location in the Philippines revealed little interest by farmers in legume components, probably because there was evidence that N was not seriously limiting there.

Tree or grass contour hedgerows have been the focus of soil and water conservation work on sloping lands. An on-farm experiment in the Philippines showed that *Cassia spectabilis* hedgerows had initiated good terrace formation after 2.5 years and increased overall rice yield in spite of strong competition on the rice rows adjacent to the hedgerow. A farming training associated study found that adopters came up with many variations, especially to reduce labour costs and to introduce hedgerow species that gave direct cash returns. Non-adopters tended to be those that had flatter lands and off- or non-farm opportunities. A study on *Vetiveria zizanioides* hedgerows at IRRI is measuring soil accumulation and changes in soil moisture.

In Eastern India, following an analysis of existing farming systems and hydrological mapping, village construction of small check dams has allowed irrigation of crops in the dry season and appreciably increased cropping intensity.

Germplasm Improvement and Crop Management Sub-programme

A summary of variety trials conducted at 'medium' and 'adverse' sites in the Philippines during 1985-88 indicated good potential for combining both yield increases and improved stability for poorer environments such as the uplands. Selection for acid soils has been carried out at sites in the Philippines and Indonesia, and promising lines have been identified, including materials from CIAT, IRAT and Brazil. Some drought screening against stress during vegetative growth was done in the dry season at IRRI until 1990, with the work of this kind now being done at upland sites. A major breeding contribution to the upland ecosystem is the development of a new plant type that has the japonica panicle type with some additional tillering from the indica type. Collaborative drought screening has been done with other countries. In India, through the Upland Consortium, three IRRI entries were the top entries and far outyielded the local check; in Saudi Arabia, under conditions of limited irrigation on sandy soils, an IRRI entry was the highest yielder; and in China, under upland conditions an IRRI entry was outstanding because of its drought resistance and brown spot resistance. Path coefficient analysis has been carried out to identify the traits most

likely to be associated with drought resistance, and a simulation model is improving the understanding of rice response to water stress.

Blast resistance work has been aimed at increasing the efficiency of mapping and utilising resistance genes using near-isogenic lines. Studies on the epidemiology of the disease have examined the effects that factors such as soil type and leaf surface composition have on disease incidence and yields. The population structure of the disease is being examined by testing resistance of lines at different sites throughout the world, and a rapid technique for typing pathogen lineages is being developed using DNA analysis techniques.

Weed control has been the main crop management factor examined. Experiments have shown that herbicides alone cannot give sustained weed control in upland conditions and must be followed by some hand weeding to be equivalent to the two or three hand weedings typical of farmers' practice. Herbicide use to control *Rottboellia cochinchinensis*, a predominant grass weed, was shown to reduce labour inputs for hand weeding by 65 percent. Other experiments have examined various combinations of hand weeding, inter-row cultivation and herbicides in conjunction with crop spatial arrangements and seed rates. Screening is also being carried out to identify cultivars that have ability to suppress weeds or to yield well in the presence of weeds. Another crop management study showed that deep placement of P increased the number of deeper roots in one variety, though not in another. It was suggested that a high ratio of deep-root to shoot might confer better drought resistance.

A collaborative project with ORSTOM has contributed to the understanding of the nematodes species of the uplands.

The Upland Consortium was established in May 1991 with member countries of India, Indonesia, Philippines and Thailand. Key sites in each country have been identified, and each has agreed to work on drought, soils, weeds, and land management, respectively; IRRI will contribute on blast.

3.4.3 Assessment

This Programme has clear and appropriate objectives, but the upland ecosystem is a complex and difficult one requiring research on a wide range of physical, biological and social issues and offering little opportunity for alleviating constraints by use of purchased inputs.

The relatively small team has made good progress and is developing its research on a number of relevant issues. It is overcoming the disadvantage of being unable to do much research of relevance at IRRI headquarters by developing very good links with NARS, and its strong focus on-farm activities is commended. It has done well to establish the Upland Rice Consortium.

The Programme recognises different sub-ecosystems within the Uplands; a site is at present being chosen in Thailand to represent a shifting cultivation sub-ecosystem, the importance of which was identified in the Lao PDR survey. We suggest

the Programme be careful not to spread its interests too widely; we suggest it should focus on only two or three characteristic sub-ecosystems that it considers most important.

A particular problem for this Programme, because of the inherent 'close-to-farmer' nature of much of the research, is in identifying strategic issues that justify IRRI's involvement. We urge the Programme to continue its vigilance during research planning to ensure that the focus is on basic processes that advance understanding, on principles of technology development that can be widely applied, and on methodologies that improve the effectiveness of research and are replicable in other situations.

We are pleased to note that there are plans to give greater attention to nutrient, soil and water management.

There has been an important long-term collaboration with CIRAD in this Programme: the current Programme Leader is a Visiting Scientist from CIRAD, and an agronomist from CIRAD will join early in 1993.

3.5 Deep Water and Tidal Wetlands Ecosystem Programme

3.5.1 Evolution and Current Focus

Deepwater rice grows for the early part of its life (1-3 months) in fields subject to drought or with only shallow flooding. It is then subject to flooding of 0.5m or more, with the peak flooding usually before flowering, and plants have to elongate rapidly. These patterns of drought and flooding can vary considerably from year to year. Local varieties are highly adapted and are photoperiod sensitive to ensure flowering in general relation to the retreat of flooding. In addition to the need to tolerate both drought and flooding, deepwater rice has to contend with problem soils. Some 7 million hectares of deepwater rice are harvested annually in Asia, though this area is decreasing as farmers gain access to irrigation and are transferring to an irrigated summer crop where modern varieties can be used (in Bangladesh and Vietnam 1.8m ha have been substituted in this way).

Tidal wetland rice is grown in coastal or estuarine fields where the water levels fluctuate with the rise and fall of the tides but the plants do not elongate. For those areas nearer the coast, estimated as about 25 percent of total area, the major problem is salinity; for much of the remaining area there are problems with acid, acid sulphate, or high organic (peat) soils. And as with the deepwater system, farmers have no real alternative to rice during the wet season. About 4 million hectares are cultivated annually in South and South East Asia, but some increase in area is likely as uncropped areas are utilized.

The broad objectives of the Programme are to develop improved rice cultivars and more efficient cultural methods and farming systems for these two ecosystems.

The research is divided into three projects (Table 3.1).

3.5.2 Achievements and Impact

Because of limited funds that can be committed to this programme, and because of the need to develop varieties for a wide range of different environmental niches, the research has been developed with increasing collaboration with NARS. At present there is collaboration with Thailand, Cambodia, Vietnam, India, Bangladesh and Myanmar. There is a resident agronomist in Thailand who is responsible for the crop management and farming systems research and for coordinating the collaborative research with Thailand and Indo-China.

For the deepwater rice, much of the breeding work previously carried out at IRRI has been gradually transferred to Thailand where there are good links with the national programme. A shuttle breeding link is operated with IRRI so an extra generation per year can be grown. The work at IRRI has increasingly concentrated on pre-breeding work with the objective of providing breeding material to NARS. This involves combining stress-relieving characters, particularly elongation and submergence tolerance, and investigating the genetics of these characters. Techniques have been developed to make the screening more efficient. For submergence tolerance, an early stage non-lethal flooding test has been developed. For elongation, gibberellic acid has been tried as a means of identifying varietal capacity to elongate. A 'shallow flooding' technique, where plants were grown in tanks and bent over, was also tried, but this proved impracticable and is being replaced by simpler, faster and more accurate techniques.

In Cambodia, following successful trials over representative sites during 1988-1990, including farmers' assessments with their own cultural practices during 1990, three deepwater varieties were released.

Research on nutrient requirements has included an investigation of the fate of applied N, and studies on the source and form of N available in deepwater soils as affected by flooding and soil pH. Cropping systems studies have shown good possibilities for intercrops such as sesame and mungbean during the early growing period of deepwater rice. Investigations have also shown the potential for early cuts of deepwater rice for forage. This work on pre-flood rainfed crops has now been devolved to NARS.

Pest management work has focused on ufra nematode, now thought to be of minor importance, and stem borer, a serious pest. Screening for tolerance to the latter, in collaboration with India, has indicated possible sources of tolerance.

A recent social science input to this programme in Bangladesh and Vietnam has enabled some needed characterisation work to be done on farming practices and the economics of deepwater rice.

In tidal wetlands germplasm research, the approach has been to ensure the provision of breeding material to NARS. A good programme of collaboration has been built up with several NARS who undertake screening for specific soil problems; India for salinity, Thailand for acid sulphate soils, Indonesia for peat soils, and Sri Lanka for acid soils.

3.5.3 Assessment

This Programme has a sensible objective in that it focuses on strategic pre-breeding research to ensure provision of breeding materials to NARS. We regard this as a particularly sound approach given the variability of local environments in which both deepwater and tidal wetland rice is grown. The large body of breeding material accumulated at IRRI that is being gradually transferred to Thailand for evaluation appears to be going smoothly and on target.

Given the location-specificity of farming conditions and practices, it seems appropriate that the crop and resource management work is linked with NARS in several countries. The Panel was pleased to see the recent work of a social scientist in this Programme to assist site characterisation on the farming systems at a number of sites.

While recognising the good work that this programme is doing, we raise the question of whether, in the longer term, IRRI should consider this as an area where some retrenchment might be possible, at least so far as core funds are concerned. We suggest this for two reasons:

1. The area of deepwater rice has decreased in some areas because, where irrigation has been possible, farmers have moved out of a rainy-season deepwater crop to a more assured and productive irrigated summer crop.
2. Although the area of tidal wetlands under rice may increase as people move into uncropped areas, some of the soils of the tidal wetlands are difficult and are unlikely to be any more than marginally productive without expensive investment in land and water management.

We believe IRRI should maintain a commitment to pre-breeding work, with the current strategy of providing breeding material for NARS. However, we suggest that other work could logically become the responsibility of NARS. There would probably be little realignment needed for the salinity and stem borer work being done under this Programme because these are also major concerns for other ecosystems.

We also suggest that IRRI observe how ICLARM's interests develop in the tidal wetlands to ensure that IRRI's and ICLARM's plans are complementary.

3.6 Cross Ecosystems Research Programme

3.6.1 Evolution and Current Focus

The CE Programme was established to characterize rice ecosystems; to use and/or develop modern scientific tools, methods, and knowledge for addressing current and anticipated rice production problems common to several ecosystems; and to develop and make available to national programmes promising technologies derived from more basic research.

The Programme initially consisted of six sub-programmes; Germplasm Evaluation, Genome Manipulation, Ecosystem Characterization and Impact Analysis, Improved Pest Management, Plant, Soil, Water and Nutrient Processes, and Rice Quality and Utilization.

In 1992, Rice Quality and Utilization was transferred to the Irrigated Rice Programme, and the rest were reorganised into three Sub-Programmes (Table 3.1).

3.6.2 Achievements and Impact

Genome Characterisation and Manipulation Sub-Programme

The International Rice Genealogy Database was completed for 3,600 cultivars and 100,000 crossing records to satisfy routine user queries. Information on the isozyme classification of over 2,000 accessions was consolidated into a central database to improve the accuracy of classifying genotypes.

Dramatic progress has been made in building up the passport database for cultivated and wild rice. In 1987, some 3,000 accessions had passport data in the database, but by 1992 some 20,000 had passport information.

Interspecies hybrids between rice and 12 wild species have been produced through embryo rescue for use in breeding of resistance to brown planthopper (*O. australiensis*), blast (*O. minuta*), bacterial blight (*O. australiensis*, *O. minuta*, *O. eichingeri*), tungro (*O. officinalis*, *O. latifolia* and *O. ridleyi*), and yellow stem borer (*O. ridleyi*). Other hybrids are from *O. alta*, *O. granulata*, *O. rhizomatis*, etc. Advanced progenies from hybrids of IR varieties and *O. latifolia*, and *O. brachyantha* are being evaluated for resistance to diseases and insects.

To assist plant selection for resistance breeding the following genes have been tagged with molecular markers: white backed planthopper (WBPH-1), Bacterial leaf blight (*Xa-1*, *Xa-3*, *Xa-4*, *xa-5*, *Xa-10* and *Xa-12*), blast [a major gene Pi5(t) and nine quantitative trait loci (QTL)], and brown planthopper.

Brown rice samples from 11 *Oryza* species involved with wide crosses were analyzed for amylose percent, alkali solubility, or protein and lysin content. The results indicate grain quality in wild rices is similar to that of cultivated indica rice.

Varietal differences in texture of cooked rices with similar amylose content were indicated by checking 'amylopectin staling' tested by Instron hardness of cooked rice. Rapid Visco Analyzer was found to be a good rapid screening technique for pasting properties of rice, with much less sample and time required than Amylograph.

Transgenic rice plants with the GUS gene or the hygromycin resistance gene were successfully regenerated and produced seeds. Further efforts are expected to produce plants with coat protein genes of tungro virus, with endotoxin gene of *Bacillus thuringiensis*, and chitinase for sheath blight.

Another culture-derived lines were developed which have higher yield in deepwater and tidal wetlands, cold and salinity tolerance, and increased resistance to pests and diseases. Also, from anther culture a low tillering and long panicle rice plant was produced and used as a seed parent in the quest for the new rice plant type.

Since 1987 more than 172,000 samples of rice seeds were provided by the genebank to IRRI scientists, mostly for evaluation studies.

Crop Ecology and Pest Science Sub-Programme

Simulation models were used to study important production constraints in Tarlac Province, Philippines, and effects of leaf damage by blast. The yield gap in Tarlac between irrigated and non-irrigated conditions ranged from 0 - 1.25 t/ha. The blast study showed the blast lesion potentially affects 3 to 5 times its area in terms of photosynthesis and respiration.

Several new measures for identifying strains of pests and diseases were found: a specific cultivar Acc.8106-R for strains of bacterial blight, IRGC 100139 for RTSV, antiserum for RGSV, and DNA probes for rice yellow dwarf.

Environmental Characterisation, Impact Analysis and Research Prioritisation Sub-Programme and Project

Characterisation work has examined the biophysical and socioeconomic environment of rice farming, and has increasingly tried to use Geographic Information System (GIS) methods. One major output was the publication of *Human Geography of Rice in Southeast Asia*.

Simulation and modelling achievements include: assistance to INGER on site characterisation and decision-making, a set of modules developed for crop simulation (MACROS), training scientists from 9 countries, models adapted for rice growth and production in irrigated and rainfed conditions, establishment of the SARP network, organisation of four SARP-related thematic workshops, and development of a version of the crop model (SOYCROS) for soybean in rice-based systems. A crop model was used to help design the new high yielding plant type, including long grain filling period (e.g., 45-55 days), smaller maximum vegetative biomass, and capacity to absorb a great amount of N after flowering.

3.6.3 Assessment

The CE Programme focus was sharpened in 1991. However, due to delayed recruitment of IRS, some significant projects such as GIS and pest science will be activated in the second half of the five year plan. Greater use of the INGER database should be made, including meteorological data and other pertinent information (including soils) concerning the test sites. That information may not always be readily available, but it would seem worthwhile trying to acquire it even if additional resources are needed.

It is difficult to assess the characterization studies. The studies done in the various sites, for example, in the Philippines and India (as reported in the 1991 Programme Report) show quite a difference in the scope and methodologies adopted. To the extent that these characterization studies are done as preludes to more extensive research in the sites, such studies may be useful and indeed essential, and the difference in methodologies can be tolerated. On the other hand, we understand the whole point of locating this set of studies in the CE Programme was to obtain a common methodology. We do not detect movement in that direction.

In Pest Science and Management, detection of three new bacterial blight races, identification of *O. glaberrima* lines for monitoring RTSV-carrying GLH, and trials to couple pest damage with the CERES-RICE model are commendable achievements.

Excluding East Asia, non-irrigated rice covers 67 percent of total rice area. Here, resource poor farmers can grow only wet season rice which yields 60-70 percent as much as dry season rice, mostly due to low solar radiation. Thus, it is very important to raise the yields of wet season rice. Since interspecies hybridization has succeeded using *O. meyeriana* and *O. granulata*, which adapt to low light intensity, these wild species possibly could be used to improve adaptation of cultivated rice to low solar radiation.

Recommendation 3.2

The Panel recommends that IRRI explore the feasibility of combining with cultivated rice the ability of some wild species to grow under low solar radiation, in order to increase wet season rice productivity.

3.7 Disciplinary-based Divisions

The following sections briefly consider each Division in terms of disciplinary expertise covered, the quality of the research, and the contribution being made to IRRI's goals. We have also tried to indicate key areas in which we believe there are currently staff shortages or gaps in the research being carried out. Our overall suggestions for priorities in filling vacant staff positions are consolidated in Section 3.7.8.

3.7.1 Plant Breeding, Genetics and Biochemistry

The Division was organized in 1989 by merging two departments, Cereal Chemistry and Plant Breeding. Genetic studies and germplasm-related activities were conducted previously within the Plant Breeding Department which has long made steady progress in varietal and germplasm improvement for yield, resistance to biotic stresses, tolerance to abiotic stresses, reduced growth duration and grain quality. The Division has 11 IRS and three visiting scientists. Research is of a high standard and there is no particularly critical staff shortage.

At least one plant breeder is assigned to each Ecosystem Programme (Table 3.2). Two breeders are working on special tolerance/resistance objectives; one for biotic stresses such as low temperature and problem soils, and the other (in

cooperation with Japan) for abiotic stresses especially bacterial blight and tungro disease. Hybrid rice breeding comprises one project of the Irrigated Rice Ecosystem Programme. Upland rice breeding has been carried out for 20 years or more. For deep water rice, breeding has been conducted by use of the rapid generation advancement for supply of early generation materials for *in situ* selection.

To widen the genetic base of tolerance to biotic stresses and to find sources of male sterile cytoplasm, interspecies hybridization has been an important part of the effort. Hybrids are used to analyze genetic relationships between different genomes or to locate specific genes introduced into cultivated rice. These genes will become useful as sources of durable resistance to different biotic stresses, or to prevent genetic vulnerability to specific diseases. The approach taken is to search for new genes in wild relatives of rice, hybridize them with cultivated rice assisted by biotechnology, analyze them genetically for different characters, and introduce desirable new genes into cultivars using traditional breeding or even gene transformation.

Tissue and cell culture has now become an effective tool. The Biotechnology group works actively with gene tagging and gene transformation. It is expected that a transformed rice with an agronomically valuable trait will be available for testing within a few years.

The Panel was concerned to learn there is at present no research work on grain quality at IRRI. We are aware of the large body of knowledge on cereal chemistry at IRRI as well as the impending retirement of the cereal chemist. It is our opinion that, while quality improvement for particular markets and cultural preferences is the business of individual nations, IRRI should measure and characterize quality aspects of its germplasm and should examine the needs for grain quality research in serving NARS.

3.7.2 Agronomy, Physiology and Agroecology

This Division was formed from the recent merging of the Departments of Agronomy, Plant Physiology, and Multiple Cropping, a move that is justified by the close links that now exist between these different disciplinary interests. The Division has a high standard of disciplinary expertise with 11 IRS. There is a strong commitment to an interdisciplinary approach.

Good strategic research is being done in physiology and modelling to help define both the improved plant type that may contribute to raising the yield ceiling for the high production environments, and the agronomic management such a plant type would require. Division scientists and plant breeders collaborate closely in this work, and the methodologies being developed should provide guidelines for tackling other yield-constraint problems and other environments.

For the intensively cropped irrigated environments, a strategic input on long term yield trends, crop growth, and changes in soil N availability is helping to identify the extent and possible causes of yield decline. This study is pointing the way towards initial management strategies that may reduce this effect and, equally important,

highlighting the complexity and importance of the problem and the urgent need for research.

Modelling has made a significant contribution not only to physiology studies and environmental characterization but also to improve the efficiency of some experimental work by pinpointing those particular areas, or treatments, needing attention. The establishment of the Systems Analysis and Simulation in Rice Production Network (SARP) is a very good initiative and should serve as something of a pattern for other networks.

The Division has collaborated with Social Science to characterize some diverse and heterogeneous environments of the rainfed upland and lowland ecosystems. The Division also conducts strategic research on drought tolerance including rooting characteristics and the role of carbohydrate storage in relation to plant performance when drought occurs at flowering. For upland systems where poor soil fertility and erosion are major constraints, weed management strategies and hedgerow systems with grasses or trees for terrace formation are major components of the research.

3.7.3 Entomology

The Entomology Division emerged from the former Entomology Department. The Division has two IRS positions and one visiting scientist with one key position still unfilled. The Division is stretched thin and is finding it difficult to meet all requests in the matrix. Research of the Division focuses on ecology, host plant resistance, IPM, and biocontrol in the broad sense. Ecology, IPM and some of the more applied research are closely linked with the IPM network and the ecosystem consortia. Much of the work shows originality. For example, in view of the possible failure of the Bt transgenic line of rice due to the emergence of Bt resistant pest biotypes, potential strategies have been suggested for prolonging the usefulness of Bt in engineered rice. Also, IR68 has been found to be much more attractive than other rices to some kinds of natural enemies of pests due to some flavonoid substance in its secretion, and hence is better protected from the insect pest. The inheritance of this property is being studied to explore its possible application. This is an inspiring new idea. Also, good quantitative knowledge about losses caused by pests has been acquired and need-based insecticide applications have been designed.

Aspects that need strengthening are pesticide-resistance of pests, biocontrol, and natural control factors in pest management.

3.7.4 Plant Pathology

The Plant Pathology Division emerged from the former Plant Pathology Department. The Division has six IRS staff and three visiting scientists. Two Programme Leaders, Rainfed Lowland and Cross-Ecosystems, come from this Division.

The guiding principle in the Division is tackling key problems identified in field production by appropriate approaches, reinforced mainly by molecular biology and systems analysis. Some valuable results have been achieved and only some examples are

given here. A simplified marker method, RAPD, has been used for the study of lineage relationship between races or strains of pathogens (*Piricularia oryzae* and *Xanthomonas oryzae* pv. *oryzae*) and will be used for tagging the resistance genes of rice. Through cooperation with other Divisions, durable resistance to blast has been studied by QTL (quantitative trait loci) analysis using RFLP techniques. An epidemic simulation model of rice blast has been developed and could be used to study the rice-pest system evolution. Biocontrol of sheath blight has been explored and some antagonistic bacteria have been isolated. A systematic study on the epidemiology of tungro disease has been undertaken, and its results may help to explain why tungro often occurs erratically or sporadically.

As long as enhanced germplasm is one of the major outputs of IRRI, research on durable resistance to blast should be among the most important issues. Strategic research is necessary on the nature, concept, and operational definition of durable resistance and physiological and genetic mechanisms, including their molecular basis. Also, applied research, involving methods of identification and methods of breeding, is needed.

Genetic engineering and molecular markers are becoming powerful tools of breeding for pest resistance. What may be important to work out is a suitable strategy to ensure that introduced resistance is durable, otherwise gene-engineered cultivars might also 'lose' their resistance. IRRI's mapping of the genes conferring durable blast resistance in the upland variety Moroberekan is promising.

3.7.5 Soil and Water Sciences

The Division was formed from the recent merging of the Departments of Soil and Water Management. In the following comments Soil Microbiology is also included because of its imminent merger here. The Division has six IRS positions, two each in soil science, water science and soil microbiology. One vacant position in soil microbiology is being recruited.

The current research thrusts include nutrient kinetics, biological nitrogen fixation, mechanisms of and screening germplasm for various stress tolerances, on-farm management for efficient water use, and enhancing productivity of problem soils. Under a special funded project, comprehensive network studies are planned on gaseous emissions from rice fields to identify the sources, strengths and mitigation options.

Some significant research contributions during the past years include an enhanced understanding of the dynamics of nitrogen in the soil-plant-atmosphere system, N management strategies (including biological nitrogen fixation) for rice-based cropping systems, improved screening techniques for tolerance to adverse soil and nutrient disorders, and improved on-farm water management through water harvesting in rainfed rice systems.

We are of the opinion that in the coming years soil and water related constraints will be key issues requiring intensive research to address issues such as 'yield decline' and sustainability. Management of soil physical properties is an area of

considerable significance but the Division has at - present - no soil physicist. Similarly there is need to strengthen considerably research in integrated nutrient management, particularly for phosphorus, potassium and micronutrients. It is suggested the vacant position in soil microbiology should be filled with a specialist who could address some of the above areas. In any event we consider that if the above gaps are not filled, IRRI's capacity to play a leading role in basic scientific areas to develop strategies for sustainable resource management will be limited.

3.7.6 Agricultural Engineering

This Division has been successful in designing machinery and implements for various farming and post-harvest tasks, as attested by the 39 patents (with 12 pending) that IRRI currently holds. There can be little doubt that much of the technology produced by the Division has been, and continues to be, extensively adopted throughout Asia.

It is difficult to judge whether the machinery has led to adverse employment consequences overall, as no impact study has been done recently. Nevertheless the Division seems to have contributed substantially to the welfare of Asian rice-farmers. We applaud particularly its successful extension work among small entrepreneurs of the region, who have successfully built on and adapted from the Division's designs. We repeat the last panel's suggestion for the Division to work more closely with the NARS to design and evaluate suitable farm machineries and implements.

Currently, the Agricultural Engineering Division sits uncomfortably within the overall structure of the Research Programmes. It is not engaged in strategic research like the other Divisions within the Research Programmes; rather it is engaged mostly in adapting technology to fit in with the different rice-growing environments. Consequently, its work yields results quicker and has a shorter turn-around time compared to the work done in the biological divisions. It is therefore difficult to synchronize its work with others in a programmatic management system requiring stable inputs over long periods. Last but not least, the Division currently has only one IRS engineer (the work of another IRS who is administratively in the Division is not in this engineering field). The IRS currently spends 85 percent time in the Irrigated and 15 percent in the Rainfed Lowland Programme, yet there are expressions of need from all Programmes. IRRI needs to examine farmers' overall need for machinery and plan the work of the Division accordingly.

3.7.7 Social Sciences

By early 1993, the core staff will be four. On the long-term visiting staff side, however, the Division currently plans to have only 1.5 persons for the next year. A frozen core position can be converted into two long-term visiting positions which, if filled, would bring the total of core and long-term visiting scientists to 7.5 persons which, although low, is not disastrous.

The work of the Division can be divided into three levels: micro level work requires farm-management and cropping-systems economics, and more recently

social anthropology; meso level work requires microeconomics; and macro level work requires both micro- and macro-economics and some capability in policy analysis.

The relative strength of the three levels of work in the Division varies with the exigencies of personnel change. In the last five years, the Division has done well at the meso-level and macro-level work, with much of the micro-level work being undertaken by the sole anthropologist in the Division. The impending addition of the farm-management economist will round off the strengths of the IRS quite nicely.

The manpower constraint within the Division is exacerbated because the Division is, quite naturally, called upon by the management to prepare data to help the institute make its presentations to the donors or to other organizations. This sometimes can be a heavy burden, and the management of the institute should recognize this in making staff allocations.

The productivity of the IRS, compared to their social science colleagues elsewhere, owes not a little to the extremely high quality of the supporting NRS. The reorganisation of the last few years and the decline in the number of IRS led the Division to shed at least a third of its core professional NRS, in the process losing some of its most skilled researchers. Since then, the Division has had little support from the management in rebuilding its NRS staff. We urge that, as the Division returns to a more normal level of IRS staffing, the Division be given more positions at this level. One or two of these positions should be capable enough to take up the task of fulfilling the management's need for data collation for its own purposes.

(The substantive part of IRRI's social science work is discussed in Section 6.5.)

3.7.8 Assessment

In general the Panel considers the standard of disciplinary expertise at IRRI is high and in accordance with what we expect at an international institute. We saw many examples of high quality disciplinary-based work, much of it channelled into an interdisciplinary approach to relevant problems.

However, we are concerned that there may be too much emphasis on interdisciplinary approaches, with too much responsibility invested in the Programme and Project and too little in the Division. We consider that, over time, this may lead to a weakening of the Divisions as disciplinary units. It should be remembered that many staff are relatively new to IRRI and that some of the Divisions have undergone quite radical changes from the previous Departments, especially where they have been created by mergers of Departments. We believe these factors may have made it more difficult for Divisions to retain their disciplinary identity during the reorganising of research to an ecosystem approach. We were pleased to hear that some Divisions have prepared a mission statement and others are doing so. (These issues are discussed further in Chapter 4).

We are not aware in detail of which current IRS vacancies IRRI proposes to fill. The highest priority competency areas that should be addressed, as we have seen them, are soil nutrient management and host plant resistance.

3.8 Research Support Services

IRRI has established a comprehensive system of research support services. This system serves all researchers, with both 'hardware' and 'software' in the form of equipment and expert advice for the execution and management of research and its associated analyses. These services, together with the IRRI library, Central Research Farm, Phytotron and other growth facilities, central computer, and other equipment in individual Divisions, make up one of the foremost rice research support systems in the world.

3.8.1 Analytical Service Laboratories (ASL)

ASL is composed of four laboratories: chemical analysis, mass electrometry, radioisotope, and pesticide residue. It has its own budget, facilities, and staff, including eight nationally recruited professional staff and thirteen trained technicians and labourers. The equipment is advanced, the staff is well qualified, and renovation is on-going. Eight new pieces of modern equipment and additional personnel have been proposed by ASL, which we consider rational.

3.8.2 Phytotron and Other Specialized Growth Facilities

The Phytotron, greenhouses and screenhouses are administered under the Central Research Farm (see below).

The Phytotron was set up in 1974, so is no longer up-to-date in some respects, although it is still well run and quite well utilized. Being a huge basic construction with high fixed assets it would be impracticable to renovate the whole complex. Improvement plans proposed by IRRI are necessary, but the items should be prioritized. More environmental-controlled experiments should be encouraged and examined more rigorously in respect to their objectives and research design, so as to bring the function of the Phytotron into full play.

3.8.3 The Central Research Farm

Based on a recommendation of the previous external review, the Research Farm was re-organised as the Central Research Farm (CRF) in 1990. At that time the departments turned over their assigned lands and farm equipment to the CRF and began to turn over their labourers in a phased program. The 1991 wet season marked the beginning of the centralized operations.

The CRF is managed by the Farm Manager, who reports to the Director of Operations. The CRF manages all lands, roads, farm irrigation systems, plus the Phytotron, glass houses, screen houses, farm buildings and farm and research plot

equipment. Operational policies, procedures and coordination are developed by the Research Farm Committee, chaired by the DDG for Research and with selected division heads as members. Subcommittees are composed as needed, but a standing Committee on Plant Protection advises on crop protection practices and pesticide regimes.

From 1990 on, the CRF has done much to renovate and improve the irrigation systems, roads and other infrastructure of the experimental farm area. Physically, the farm is in much better shape than before because of the renovations and improvements. Changes in farm operations include moving to two cropping seasons with two short closed seasons in between for pest control and farm management reasons.

Changes in the CRF have resulted in problems of timeliness and quality of field services to research. We heard complaints about poor land preparation, in particular land levelling, imprecise fertilizer application, and difficulties in accomplishing specialized tasks required by researchers.

We are concerned that cost-cutting considerations and operational changes may have hampered quality services by CRF to the researchers. We are also concerned by possible adverse effects of over-centralization. Consider, for example, mechanization of the farm. Research farms can only be mechanized (using large machines) to a limited extent, especially in irrigated rice. Some operations must necessarily be carried out using smaller, specialized machines or tools or, in some cases, even carried out by hand. The main consideration should be the needs of the research, not the convenience of the farm.

The Panel was surprised to learn in the Programme Report to the Programme Committee (of the Board of Trustees), dated 21-22 September, 1992 (p.5 of CRF report) that, "...it was possible to dry out all the fields, and for the first time in the history of IRRI, deep plough all research plots". The Panel considers deep ploughing to be an extraordinary measure in puddled rice fields with an established hardpan. Our concern is borne out by the following quotation from that same report, "Dry ploughing disturbed the field levels and presented problems for precise water control which aggravated the snail problem and the establishment of direct seed (sic) crops". IRRI assures us that the ploughing did not alter the fields significantly and that long-term trials were not deep ploughed. While the Panel understands that the long cycle of continuous or nearly continuous anaerobic conditions may need to be broken, we believe measures, if needed, should be taken only after careful consideration and then slowly and incrementally, with proper controls and experimentation, to assess possible effects and reasons for these effects. We were especially concerned that some of the reasons for yield decline at IRRI farm might be difficult to learn, if experimental fields were transformed by farm-wide practices.

The Panel believes the CRF and its attendant units, including the Phytotron and greenhouses, should be more closely associated with its end-users, the researchers, and that the culture of the CRF should be more of customer service. The present system of providing services to research needs improvement in quality control and timeliness. The Divisions also need more specialized labour to meet research needs; that need is probably met best by improving the labourer component in the Divisions. In that way some tasks can be carried out centrally, yet allow the Divisions to have direct

control of specialized help for certain tasks, without compromising the quality of research. The Panel also suggests that, in order to meet better the needs of its end users, the researchers, the CRF should be administered under the office of the DDG-Research.

3.8.4 Electron Microscope Unit

Two electron microscopes, transmission and scanning, managed by the Division of Plant Pathology, are available for use by all IRRI scientists. In the past five years, about 50 IRRI scientists have used the EM facility in their research which includes ultra morphological and ultra structure studies in plant pathology, tissue culture, N₂-fixing bacteria as well as azolla.

3.8.5 Biometrics

The Statistics Department was changed in 1990 to Project Management Services and Biometrics; it was renamed Biometrics in 1992. Since 1990 the Head of this unit has also served as the Head of the Liaison, Coordination and Planning unit for IRRI.

Since the last review, biometric and statistical services have changed significantly. For more than two decades the Statistics Department provided computational services for scientists; these services were terminated in 1990. Efforts are now being made to provide in-house training in statistical procedures and consultation services to researchers and programmes. In 1991, 318 walk-in biometric consultations and 10 biometric training courses were conducted. Such services have played and will play an important role in improving the mathematical and statistical abilities of the staff and hence the quality of research.

The Panel believes IRRI needs strong Biometrics support, in particular for the ecosystem programmes, genotype x environment studies and related biotechnology studies, natural resource management, and training and assisting IRRI staff. We concluded that biometrics services have suffered during the period the Head of the Unit has carried out centre-wide administrative duties. In our judgment, more senior-level capacity in biometrics is needed to help the Programmes and Divisions, to train NRS in statistical and biometric procedures, and to participate in research requiring new interdisciplinary approaches, particularly in natural resource management.

3.8.6 Assessment

In general, IRRI has a good system of research support services. The recent changes in IRRI have affected the support services. The establishment of the Central Research Farm (CRF) has been a major change. We believe the CRF has made significant improvements in the form of infrastructure and in centralizing some services, but operational problems have arisen. The culture of the CRF should be more of customer service and it should be more closely associated with its end-users, the researchers.

3.9 Overall Assessment

3.9.1 **The Ecosystem Approach and the Research Programmes**

The adoption of an ecosystem approach has highlighted two important features of IRRI's research goals:

- a commitment to poorer environments as well as the more productive ones;
- recognition that rice improvement must be set within the wider context of the environment and the farming system in which the crop is grown.

Both these features were a part of IRRI's earlier work but the ecosystem approach has made them explicit. We commend IRRI for making its stance clear on both these issues.

The major effect that the ecosystem approach has had on the research itself is that it has encouraged a goal-oriented, interdisciplinary focus in which teams of scientists have come together to work on a specific problem. This aspect was not absent from earlier work but we believe there has been a major change in the degree to which it has been adopted. We have been impressed by the willingness of scientists to work together and by the knowledge they have shown of each others research.

We believe, therefore, that the ecosystem approach is of overall benefit and that it will have a significant positive influence on IRRI's future achievements. We warmly commend IRRI staff for the commitment they are showing to the approach and the effort they are giving to make it work.

The allocation of funding resources across the ecosystem programmes was given in Table 2.1. Taking the proposed 1993 figures, the allocation to the two more favourable environments, Irrigated and Rainfed Lowland, is 61 percent compared with 15 percent for the two least favourable ones, Upland and Deepwater and Tidal Wetlands. Broadly, we have no disagreement with IRRI on this allocation and we consider it reflects a reasonable balance of productivity and equity demands. However, we do have some concerns that IRRI may be trying to do too many things. While we do not suggest any immediate changes in the balance of research effort being directed at the respective Programmes, in the event of further future rationalisation of research priorities, we add our comments on the relative priorities of the Programmes as we see them.

We have already indicated that, although we acknowledge good work in the Deepwater and Tidal Wetlands Programme, we believe that in the future, IRRI might be able to reduce its efforts in this area. The area of deepwater rice has decreased in recent years, giving way to dry season irrigated rice, and some of the tidal wetlands have difficult soils. IRRI could still retain its interest in the very strategic pre-breeding work, but the responsibility for other work could be relinquished to the NARS, many of whom already have a close involvement in this research. However, we would

add that any decisions on this Programme should be done on the basis of accurate information about the areas and likely trends in both deepwater and tidal wetlands rice.

Regarding the Upland Ecosystem Programme, on balance, we support IRRI's attention to this environment, not only for equity reasons but also because we believe there are genuine strategic issues that require serious research: the provision of varietal material that will give higher and more stable yields in the harsh upland environment; a better understanding of the fragile resource base and the processes that determine the efficiency of its utilisation; and the development of methodologies that enable strategic issues to be tackled in an often inherently 'close-to-farmer' situation. We would add that IRRI's own involvement in upland research will ensure that IRRI is better able to provide a backstop global support to those areas outside Asia where the upland system is often of high priority.

However, it is in the complex and difficult upland ecosystem that there is potentially the greatest danger of trying to do too much. We repeat our suggestion to focus on only 2 to 3 characteristic sub-ecosystems, and we reemphasize the need for constant vigilance in trying to identify genuine strategic issues. The Programme must avoid becoming simply an evaluation network testing location-specific technologies.

We have little to add to previous comments on either the Irrigated or the Rainfed Lowland. As in IRRI's earlier work, these are clearly high priority areas where the needs and pay-offs are highest, and quite rightly IRRI is giving these greatest attention. Moreover, in the more intensive production systems, there are emerging 'second-stage' problems, notably the evidence of yield decline and the narrowing yield gap, that underscore the need for IRRI to place high priority on these systems.

The Cross Ecosystems Programme started off in 1990 as the largest programme with 36 percent of research resources but has been gradually reduced to 25 percent. This has occurred largely because of transfers to the Irrigated Programme. While we have no particular disagreement with these reallocations, we would at the same time have no conceptual problem with a large Cross-Ecosystems Programme. If this Programme is viewed as the rightful home for cross-cutting strategic research issues, for research on basic processes or for innovative projects, then it would seem natural to us that such a Programme would accommodate a large part of IRRI's research. At the same time, even though some of the research in this Programme may be more strategic than in the other Programmes, the eventual practical goals should be questioned just as rigorously. And a particular question that needs to be asked in evaluating research from the Cross-Ecosystems Programme is what it has produced for the specific ecosystem research and what linkages are necessary to make sure it is utilised.

We agree with IRRI's efforts to reduce the number of research Projects; the present number of 22 as a total of all Programmes seems to us about right, given the fact that resource accountability is at Project level. However, this means that individual Projects are large, encompassing several activities. In such a situation it can be easy to overlook the need for regular and careful assessment of each individual activity, and it may be all too easy for an activity to continue simply because the Project as a whole is continuing. Thus we emphasize the need for research at all levels - Programme, Project

and activity - to set clear targets and to assess regularly whether these targets are met, whether they remain realistic, or indeed whether they need to be changed. It is only by this process of accountability that the overall research is likely to maintain its focus on the key issues and to make real progress. We comment on the managerial aspects of this in Chapter 4.

3.9.2 The Disciplinary-based Divisions

We expressed our concerns earlier that too much emphasis on an ecosystem approach, with its requirement for interdisciplinary teamwork, runs the risk of minimising the importance of the individual disciplinary inputs, and that this in time may lead to an erosion of disciplinary standards. Although we commend IRRI's change to Ecosystems Programmes, we believe the emphasis on these Programmes may have gone too far at the expense of the Divisions. In our view the Divisions at IRRI have the primary responsibility for maintaining the disciplinary excellence upon which IRRI's continuing contribution to rice research will depend. We urge IRRI to seek ways in which the Divisions' role within the matrix structure can be strengthened so they are clearly seen to have the responsibility for maintaining disciplinary standards, for providing their scientists with the opportunities for research that will be recognised within their disciplines, and thus for continuing to attract scientists of high calibre. We make further comments on this point in Chapter 4.

3.9.3 The Research Contribution

We are very conscious of the fact that we have seen only a cross-section of IRRI's research. There is a large number of diverse, and often very specialised, components in IRRI's research portfolio and it was not our intention - nor indeed would it have been within our expertise - to try to review all aspects in detail. We have attempted, therefore, to see a cross section of the research so we can make reasonably informed judgements of its quality, its focus, and its contribution to IRRI's goals.

We are also conscious that, because of the major change that IRRI has made towards the ecosystem approach, we have chosen to spend much time reviewing how satisfactorily this is working and how effectively the Programme and Project teams are carrying out their research. This has allowed little time for individual scientists to inform us of their personal contributions.

It is with this background that we list the following aspects that have come to our attention as significant contributions to IRRI's goals during the last five year period:

- the continuing world-wide distribution of specifically targeted genetic material through many collaborative efforts and through INGER;
- from studies in both experimental plots and farmers' fields, recognition of the importance of a yield decline in intensively irrigated systems; the development of an interdisciplinary approach

that is providing a better understanding of the problem and the research needed for its solution;

- the interdisciplinary effort of breeders, crop physiologists and modellers to produce an improved plant type and associated management system that will raise the yield ceiling for the high production environments;
- the continuing transfer of pest and disease resistance genes from wild rice species;
- the collaborative work between social and biological scientists in characterising the farming systems of the poorer environments into which IRRI will give more attention;
- the establishing and developing of high-quality biotechnology research that has made rapid progress in tissue culture, gene mapping, linkage with RFLP markers, and the development of techniques for the successful regeneration of plants from protoplasts;
- particularly for the rainfed lowlands, the improved understanding of the nitrogen economy, including the fate of applied nitrogen and the contribution of biologically fixed nitrogen;
- the establishing of a modelling capacity to assist in several key areas of research including: prediction of yields in relation to the environment; nitrogen management and sustainability of high yielding systems; designing new plant types; linking with GIS for environmental characterisation;
- as part of an integrated pest management strategy, the development of a need-based approach to pesticide use from studies of pest population dynamics and crop yield losses.

CHAPTER 4 - RESEARCH MANAGEMENT

Perhaps no other change at IRRI in recent years has had as major an impact on the lives of its scientists as did the shift to a matrix management system.⁵ IRRI staff were accustomed to operating in a system dominated by strong disciplinary units; new staff who recently joined IRRI often came from academia where a similar tradition exists. The shift to a programme-oriented structure came as a 'culture shock' to most. The rules, constraints, expectations and behavioral demands of the new system were foreign to staff. Yet, staff went along, some of them reluctantly, and gave the new system a try.

It has now been two years since the matrix system was initiated at IRRI. Two years is a relatively short time for getting the 'bugs' out of any new organizational system and, therefore, a full assessment of its effectiveness would be premature at this stage. However, there is some evidence of what seems to have worked and what has not. Also, many staff have shared with the Panel their experiences with "making the matrix work". For these reasons, we have decided to comment on the matrix and other aspects of research management at IRRI, with the intention that feedback from an outside group like ours may help IRRI make some mid-course corrections. Our comments cover seven areas:

- staff perceptions about matrix management;
- transaction costs of matrix management;
- disciplinary excellence;
- research projects and activities and their management;
- linkages between research and international programmes;
- management of research consortia and networks;
- management of collaborative research with other IARCs.

The first five areas relate directly to aspects of matrix management. The last two concern management of collaborative research.

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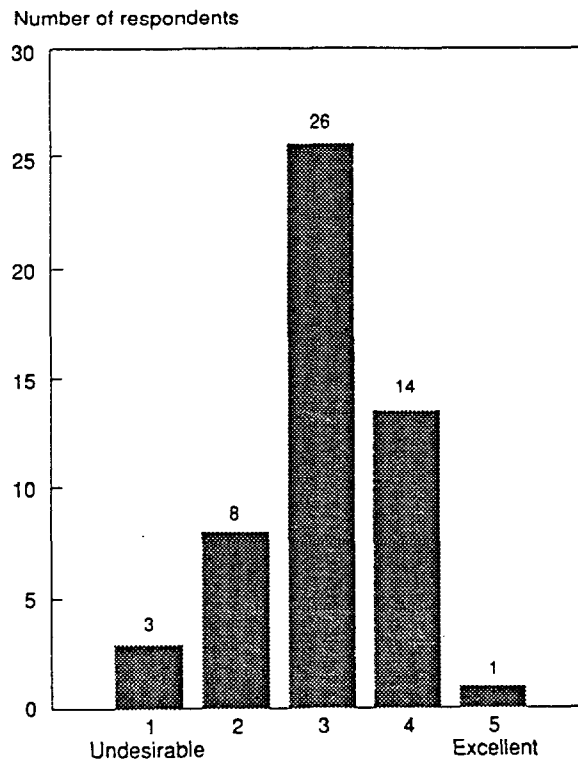
See Chapter 2 and Section 3.1 for a description of how the matrix system is organized at IRRI.

4.1 Staff Perceptions About Matrix Management

During the main phase of our review, the Panel conducted a confidential questionnaire survey of internationally recruited research staff to ascertain their views on the advantages and disadvantages of the matrix approach and to obtain a subjective, quantitative estimate of its effectiveness. The measure of effectiveness was based on a five-point scale ranging from 'undesirable' to 'excellent'. A total of 52 responses were received, practically all from staff playing some role in management or implementation of research projects. This reflects an 80 percent response rate.

As Figure 4.1 shows, opinions of IRRI's research staff vary widely about the effectiveness of the matrix approach. Exactly half of the responding IRS give it a ranking at the mid-point between 'undesirable' and 'excellent'. The remaining half are about equally divided between more favourable and unfavourable sentiments about matrix management.

Fig. 4.1 Effectiveness of IRRI's Matrix Approach as seen by Internationally Recruited Staff (n = 52)



This pattern of responses is roughly the same for staff with different lengths of tenure at IRRI, with one slight difference. Staff who have been at IRRI six or more years are slightly more positive about the effectiveness of matrix management than those with a tenure of less than six years.

The scientists at IRRI saw the following to be the key **advantages** of the matrix approach (listed in order of decreasing frequency of mention):

- fosters interdisciplinary research and promotes research collaboration;
- research directions, priorities, goals and outputs are clear;
- better communication among staff, better flow of information;
- better use of resources;
- greater transparency and participation of staff;
- clear responsibility and accountability of scientists;
- allows research to be directed at the problems of less advantaged ecosystems.

The most frequently mentioned **disadvantages** were as follows (again, listed in order of decreasing frequency):

- excessive bureaucracy, red tape, paperwork, reporting requirements;
- too many meetings;
- unclear responsibilities, too many bosses;
- too much time spent on management and administration;
- less time for science;
- slow decision-making;
- scientists' time split too many ways;
- exclusion of International Programmes from the matrix;
- decision-making authority too centralized.

The advantages and disadvantages of matrix management mentioned by IRRI scientists are almost identical to those typically given in other organizations using a matrix framework. A matrix organization reflects an overlay of two structures: one

based along input lines (in this case, disciplines), and the other along output lines (or programmes). Thus, it has the advantages as well as the disadvantages of both output- and input-based organizations. When one side of the matrix dominates the other (through the way resources flow or decisions are made), many of the disadvantages mentioned by staff reflect the concerns of the weaker dimension.

As a Panel, we applaud IRRI's move to a matrix management system because it has introduced an output-orientation to the research programme that did not exist as strongly in the earlier structure. The matrix system has allowed IRRI to link the outputs of the Centre's work to the needs of its clients, thereby increasing the emphasis on **relevance** of its efforts. Also, the explicit focus on client needs, goals, strategic directions, and programmes has enabled IRRI to better anticipate and manage change. At the same time, the move to a matrix system has enabled IRRI to maintain some focus on scientific quality and disciplinary aspects of research. Thus, in many ways, the new structure reflects a compromise between IRRI's old input-oriented structure and the new output orientation brought about by the IRRI strategy.

We also applaud IRRI's efforts to make the matrix work. The whole institute has been engaged in an unprecedented team building effort. A clearly visible consequence of this effort is that the staff are now able to communicate with each other more effectively than before. They understand each other better, are more tolerant of each other, and are better able to give and receive feedback. As a result, there is a greater and more visible unity of purpose. The IRRI mission and strategy seem to be well understood by the scientists. Also, staff seem clearer about how their own work fits into the overall IRRI programme.

The unity of purpose we have observed, coupled with the fact that the creators of the IRRI matrix are the IRRI staff themselves, give the Panel hope that IRRI is in a strong position to mend the matrix when it begins to stand in the way of good research. The matrix should be seen for what it is: a tool for accomplishing the IRRI mission in the most efficient way, and subject to modification when the mission is changed or inefficiencies creep in.

In our judgment, it is timely for IRRI to take a close look at ways of improving the functioning of the matrix. The list of disadvantages mentioned by IRRI staff is a good starting point for this examination. We comment below on four aspects that are important: transaction costs of matrix management, disciplinary excellence, project management, and linkages between research and international programmes.

4.2 Transaction Costs of Matrix Management

The strong comments made by IRRI staff about the disadvantages of the matrix system suggest that well-organized and equally strong efforts need to be applied in a sustained manner to reduce what economists call the 'transaction costs' of the matrix management system - that is, the time spent in meetings and negotiations and the amount of paperwork necessary to plan, execute, monitor, and evaluate the research programme. There are well-tried methods to reduce such transaction costs, such as

providing training to those scientists who lack skills in project management, decentralizing decision-making to the lowest possible level, systematic efforts to organize and run meetings more efficiently (incidentally, one member of our team reported that an organization suffering from similar ills found a short-term solution in banning all morning meetings), and determined measures to improve electronic communication and management information systems. Some of these measures are already being applied at IRRI, but the Panel believes that a sustained, systematic effort, led from the Director General's office and strongly backed by him, could yield considerable gains in reducing the present overload of management burdens on senior scientists.

4.3 Disciplinary Excellence

IRRI's shift to a matrix management system elevated programme needs over disciplinary concerns. All resources devoted to research began to flow through the ecosystem programmes. By and large, disciplinary units became subservient to programmes, projects and their goals. 100 percent of the time of the scientists began to be budgeted to research projects. A scientist's time began to be split among several discrete activities. Shortage of funds and understaffing meant that the few scientists available in some divisions (such as Social Science and Soil Science) were carrying the total burden of servicing all projects requiring inputs from that discipline. Many scientists began to feel they had no 'breathing room' or flexibility to pursue their own scientific or disciplinary interests and needs. Every effort needed to be fitted into a 'proper' project with several stages of approval. In many ways, the scientist's creativity was being locked into producing highly specific programme outputs.

As noted earlier, we applaud IRRI's shift towards a matrix system that has a strong programme orientation. However, we believe that the pendulum has swung too far in the output dimension of the matrix.

It is true that all of IRRI's efforts should be directed towards achieving its mission, programme goals, project objectives, etc. However, this static production-oriented view needs to be balanced against a dynamic 'sustainability' perspective. Most organization theories (like their counterparts in agricultural sciences) argue that increasing or maintaining the productivity of the resource base (in this case, human) is at least as important as the levels of production at a given point in time.

It is for this reason that most successful organizations place highest priority on attracting, retaining and further developing a human resource cadre that would give them a competitive edge over similar organizations. This is particularly important for research organizations which rely almost exclusively on the creativity of individual scientists.

The matrix, by definition, splits the disciplinary effort into many programme-oriented projects. Yet, to serve the organization better in the long-run, disciplinary divisions need to integrate the learning of their members and monitor and reinforce the quality of the scientific effort emanating from them. To help the programmes better, they may need to undertake some exploratory studies, perhaps too

small or specific to factor into the programmes. They may also need some single-discipline projects that do not fit into ecosystem programmes (with the possible exception of the Cross-Ecosystem Programme) or that may be more efficient to manage within the division (such as a single discipline research network). Division staff also need to develop or sharpen their disciplinary capabilities to remain up-to-date, and to improve their career prospects.

Recommendation 4.1

The Panel recommends that IRRI adjust the matrix management system to provide the Divisions more authority and means to strengthen disciplinary capabilities and rigour, and to ensure that the emphasis on ecosystem research programmes does not lead to an erosion of disciplinary expertise.

We would like to make four additional comments on furthering scientific excellence at IRRI.

First, we applaud the effort IRRI divisions have initiated to develop clear statements of their missions. This is an excellent way to enhance or develop divisional identities, identify goals and explore ways in which divisions can help further the IRRI mission. Such an effort should undoubtedly focus also on the career development of individual division staff (both IRS and NRS).

Second, we feel that in a premier research institution like IRRI someone within the organization needs to play the role of a 'chief scientific officer', as distinct from 'chief executive officer' or 'chief operations officer'. The primary role of the chief scientific officer is to ensure the quality and integrity of the institute's scientific work. This requires continuous monitoring of scientific quality, awareness of scientist concerns, creation (or protection) of an atmosphere in which good science can be practised, and upholding of values promoting creativity (such as 'freedom from fear of failure').⁶ Although everyone at a scientific institution should be a champion of good science, someone with conviction, a 'feel' for science and the concerns of the scientist, and in a position of authority, should carry the explicit responsibility to protect and advance good science.

At IRRI, the DDG-Research carries the dual responsibility of 'chief scientific officer' and 'chief research programme officer'. Because IRRI's priorities were placed initially on the 'output' side of the matrix, the DDGs-Research have emphasized the programme officer role. It may now be timely to balance both roles.

Third, as we comment in greater detail in Chapter 7, IRRI's internal and external review systems should enable IRRI to receive feedback on disciplinary excellence. Peer reviews of disciplinary activities, with a major focus on scientific quality,

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Philip Roussel, Kamal Saad, Tamara Erickson, *Third Generation R & D*, Harvard Business School Press, 1991.

and more explicit attention to divisional matters by the Board's Programme Committee are among the ways IRRI could further its scientific excellence.

Fourth, at a more pragmatic level, it appears from the responses of the scientists to the survey questionnaire, and from our face-to-face interviews with them, that the time of an average scientist is being split too many ways in the current matrix system. We understand that IRRI is actively considering some proposals on limiting the number of projects of a scientist to a maximum of three, with a major contribution to only one. There are also other proposals which argue for linking each scientist more closely with a single programme, in order to avoid the bureaucratic and communication requirements of being involved with two or more programmes. These are all sound ideas which, when coupled with the other suggestions made above, could further advance the traditionally high disciplinary excellence of IRRI.

4.4 Research Projects and Activities and Their Management

Projects constitute the backbone of a matrix management system. In fact, so long as an institute has the right project portfolio and project staffing, theoretically, its whole research programme can be managed with little attention to the two axes of the matrix. For this to happen, one needs the 'right' projects, good staff, and authority to manage them.

The IRRI research programme is now organized into 22 distinct projects, which are further divided into about 100 activities. The number of projects has been reduced from 49 over the last two years. This in itself is a welcome development, so long as each project in the portfolio has a clear output-oriented identity, unambiguous objectives, measurable milestones and a projected finite life.

Some programmes have very few projects but they are broad in their coverage. For example, the Upland Rice Research Programme has only two projects, one on 'sustainable land and resource management' and the other on 'germplasm improvement and crop management'. The Cross-Ecosystem Research Programme has five projects, but with few apparent substantive links among them. This should perhaps be expected because strategic methodological or substantive concerns cutting across rice ecosystems do not need to be inter-linked. (If they were, they would probably be combined into a single project).

Having the 'right homes' for the projects is extremely important. A strategic research project geared mainly towards the problems of a specific ecosystem should naturally be placed in that ecosystem programme. Having it placed in the Cross-Ecosystem Programme would have the effect of distorting the picture on the Institute's priorities and mask the true allocation of resources to ecosystems. However, IRRI's mandate covers many strategic research concerns which can be handled best through the Cross-Ecosystem Programme. Placing the oversight responsibility for a project in a division could be considered when it is dominated by a single discipline. For programme accounting purposes such projects could be classified in the respective ecosystem programme.

Detailed documentation exists for each project and activity and programme and project managers receive periodic financial reports on the project's progress. Also, the Programme Committee of the Board reviews progress in projects annually.

It is not entirely clear under what circumstances IRRI would terminate a project. Activities within projects do get terminated or reduced in scope because of departures of staff or shortage of funds. Some activities are transferred from one project to another, maybe in a different programme. There has been considerable fine-tuning to define and redefine projects, as illustrated by the reduction and redefinition of projects from 49 to 22 in two years. This accounts for some of the dissatisfaction with the bureaucracy of matrix management expressed by staff.

We would like to make three other comments about project management at IRRI.

First, we are not entirely convinced that each IRRI project has a clear focus that would facilitate monitoring of progress towards well-defined objectives. Some of the projects have a distinct 'sub-programme' flavour because of the breadth of their coverage and the continuing nature of their activities. The activities within projects, perhaps in part because most are built around a single scientist, are more like 'projects' in the classical sense of having clear foci, objectives, timetables, budgets and a finite life. We sympathize with IRRI that it would be extremely inefficient if one tried to manage the research programme in terms of some 100 odd activities, and therefore it is essential to have the activities reflect components of major research thrusts. At the same time, these research thrusts, as reflected by individual projects, should have clear enough objectives and milestones for the Institute management and the Board to decide periodically whether to expand, contract, or end them. Otherwise, projects could continue indefinitely, with occasional modifications, because of the natural tendency of some scientists to perpetuate their favourite activities.

Second, IRRI should examine closely its total 'project portfolio' from time to time. To do this accurately IRRI needs to have a good understanding of the risks as well as the expected payoff associated with each project. These factors change over time. New discoveries (by IRRI or others) could reduce uncertainties associated with a project. Also, expected benefits could change because of external circumstances. Increasing scarcity of unrestricted funds necessitates a bold approach to project selection in order to avoid the temptation to focus on activities that come equipped with ample special project funding but are not sufficiently oriented to IRRI's priorities.

Third, managers of projects (in IRRI's terminology, 'Project Coordinators') should be allowed to **manage** their projects. As we noted above, projects are the backbone of matrix management and the person closest to the problems of a project is the project manager. Managers on the two axes of the matrix should help in the integration of efforts, but not try to micro-manage projects.

This is why having clear foci and milestones are important. For all intents and purposes, after all approvals, the project manager and her/his team could be left

alone to do their job, except for occasional reporting of progress and sharing of ideas, more for mutual learning and help than bureaucratic control.

4.5 Linkages Between Research and International Programmes

Like the research programme, IRRI's international programme activities are managed through projects. The Panel's assessment of these projects and activities is covered in the next chapter of the report. Here we focus on the mechanisms for linking IRRI's research programme with its other programme activities.

As they are currently constituted, Research and International Programmes reflect two separate and distinct 'businesses' of IRRI. Research is responsible for generating new knowledge, increasingly in partnership with stakeholders in national programmes, sister IARCs or advanced developing country institutions, and institutions in developed countries. International Programmes is responsible for providing services to IRRI's clients and, to some extent, to IRRI's research arm. The service provided by International Programmes gets its strength from IRRI's competence in research. Most of the services provided are thus in the form of 'research-based services'.

Although some IRRI staff work exclusively in Research Programmes, there are others who both do research and contribute to International Programmes (such as research staff contributing to training or information activities).

That there is need for close links between Research and International Programmes is obvious. Both sides gain from such exchanges, not to mention the clients and partners of IRRI, who would benefit from likely increases in the relevance of IRRI's work resulting from these exchanges.

What is not clear to the Panel is how close or organic these links should be. One option that is now being considered by IRRI is to extend the current Research Programme matrix in both the programme and division dimensions by adding International Programmes and Centres to these dimensions. This would certainly help unify IRRI's work and facilitate closer interaction among staff in these two programmes.

On the other hand, there are several factors which argue for maintaining some distance between Research and International Programmes. First, the two businesses have somewhat different identities, values, ethos and principles. The innovation business and the environment it requires are quite different from those in a service enterprise. Mixing the two may water down, and indeed weaken, both cultural systems. Second, a larger matrix is likely to lead to a geometric increase in the complexity of managing relations. Third, each of the two dimensions or 'axes' of the matrix would lose some of its homogeneity. Disciplinary divisions dealing with knowledge generation do not mix well with International Programme 'centres' which are involved with service delivery, and ecosystem programmes have a character different from International Programmes. Fourth, integration of efforts in a matrix is enhanced when both dimensions report to the same 'boss'. Having two bosses manage a matrix jointly could lead to many unforeseen complications and inefficiencies.

It is obvious from the above that we would urge IRRI to proceed cautiously in any move to expand the research programme matrix. Since, according to conventional wisdom, structure follows strategy, we would ask that IRRI explore carefully the strategic imperatives that lie behind, and call for, such a structural change.

The distinction that should be made is perhaps between 'tight' versus 'loose coupling'. Tight coupling is counterproductive to research and, thus, the research programme matrix requires only a loose coupling of ecosystem programmes and discipline-based divisions, with the research projects as the driving force of the overall research programme. Some of the International Programmes, on the other hand, require tighter coupling, because tighter control and management often leads to greater efficiency in a service organization.

These notions relate to the possible internal coupling patterns in each of the two sides of the IRRI enterprise. If the argument above is correct, linking a loosely-coupled research operation to a tightly-coupled service business needs to be approached with care. To protect the loose-coupling in research, International Programmes needs to be linked with research in a loosely-coupled manner.

One option is to keep the research matrix intact, and assign staff who currently work exclusively in International Programmes to existing disciplinary divisions. If the existing divisions do not cover the disciplinary specializations of these staff, one or two new disciplinary divisions could be added to one side of the matrix (such as information and learning-related disciplines). This would have the effect of providing a disciplinary 'home' to all IRRI programme staff. Core- and complementary-funded staff would have greater opportunity for interaction with each other, as would staff in 'new' and 'old' disciplines. And IRRI would not be mixing inputs with outputs.

Under such a scenario, Research and International Programmes would be linked with each other in a loosely-coupled manner. The 'output' dimensions of both enterprises would be managed by the two DDGs, as at present. If new disciplinary divisions were to be added to the research programme matrix, supervision of scientific and disciplinary interests and excellence of staff in the new divisions would most likely fall under the responsibility of the DDG-Research. Linkage across projects in the two separate enterprises could be achieved through *ad hoc* coordination devices.

4.6 Management of Research Consortia and Networks

IRRI has recently introduced some new terminology related to agricultural research networks. In a recent paper prepared for the Board distinctions are made among the following:⁷

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The definitions are excerpts from *Networks and Research Consortia: Their Functions and Roles Within IRRI Mandate*, Position Paper F, Programme Report to the Programme Committee, 21-23 September 1992.

- A **Research Network** involves formally-linked teams of scientists from IRRI and other selected institutions to conduct research that is driven by a predetermined theme and/or a set of research tools.
- A **Technology Evaluation Network** is a voluntary and open, informal association of scientists and/or research organizations with common interests. The members work together to share, exchange and evaluate technology, experiences and information.
- A **Research Consortium** involves a limited number of national and international institutions formally organized to collaborate in research, training and technology generation activities designed to meet mutually defined objectives.

In terms of more commonly used network typologies (such as that described in Plucknett, Smith and Ozgediz⁸), IRRI's Research Networks (such as SARP and the planned Asian Rice Biotechnology Network) and Consortia (such as the two on Rainfed Lowland Rice and Upland Rice) fall under the rubric of 'collaborative research networks'. The distinguishing characteristic of such networks is that the main output of the network that is produced collaboratively is **research**. IRRI's Technology Evaluation Networks (such as INGER), on the other hand, exist primarily for exchange, testing and consultation. Here research is a by-product, but not the **main** output of these networks.

We applaud the renewed emphasis on collaborative research networks at IRRI. Using IRRI's terminology, research networks focusing on specific researchable problems and providing the network participants a mutual learning experience in relatively new fields are likely to have high payoffs, both in terms of generation of new knowledge and in institution building. Because a true collaborative research network is as strong as the weakest link in the chain, IRRI as the network-coordinating institution, carries important organizational and management responsibility to keep quality high and prevent the network from turning into a one-way exchange mechanism. In this regard, the disciplinary divisions of IRRI are likely to play important roles in ensuring the scientific integrity of the research networks and in linking network findings to IRRI's research programme.

Research consortia are essentially closed-membership collaborative research networks. CIP has considerable experience in facilitating collaborative research initiatives similar to IRRI's consortia. For example, PRECODEPA, a regional cooperative programme for potato research and production involving nine Caribbean countries in which CIP participates, has had long experience that could be valuable to IRRI.

While the concept of a research consortium is very attractive (interdisciplinary research teams of both IRRI and national institution scientists tackling

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Donald Plucknett, Nigel Smith and Selcuk Ozgediz, *Networking in International Agricultural Research*, Cornell University Press, 1990.

together the generation of knowledge and development of holistic technology for specific rice ecosystems"), making it a reality is a tall order. Consortia are still in the experimental domain. So far IRRI has gained experience in **planning and establishing**, but not in generating research results through them.

As IRRI recognizes, the consortium approach relies on true peer relationships among scientists, often in different institutions. If such relationships are weak or are difficult to establish, making the consortia work may take a long time.

While encouraging IRRI to make the consortia a success, we would like to make the following cautionary comments:

- At the moment, the consortia cover very broad, comprehensive mandates. If their foci are not narrowed, such as by partitioning them into a series of more narrowly defined research problems with specific aims or by reducing the scope of the effort in initial years, fully **collaborative** work may not emerge.
- A consortium should not be viewed as or allowed to become an **institution**. It should remain an organizational **mechanism** or tool for collaborative research. It should have an uncomplicated structure.
- IRRI needs to remain an equal partner, and not the main driving force, of the consortia. The NARS should be at the forefront of the effort, not just in appearance. Fiscal decisions should be made by the Steering Committees, with IRRI's participation, not by IRRI alone.
- The long-run sustainability of the consortia will depend to a large extent on the participant countries' willingness to contribute their own resources to the effort. This commitment should be sought from the beginning.
- The research effort should be mainly at the strategic level. This requires the involvement of highly competent scientists in all partner institutions. The acid test of the consortia concept will probably be its ability to attract such talent to the solution of strategic research problems, without infusion of massive amounts of outside funds. To the extent that a consortium brings new learning experiences to all participants, such as joint effort to develop new methodologies, its chances of success will be high.

4.7 Management of Collaborative Research with Other IARCs

IRRI has collaborative relationships with most CGIAR centres. The nature of these collaborative efforts is described in Chapter 7.

When one looks at the CGIAR System as a whole, it seems that the cases of successful collaboration in research are few and far between, in the sense of two or more parties joining forces to address a research problem jointly (as in true collaborative research networks.) This is an observation about inter-centre collaboration in research in the CGIAR, and **not** an indictment of IRRI. In fact, IRRI, in our opinion, is one of the most 'open' centres in the System, in the sense of "openness to partnership and collaboration".

In the past, most of the collaborative research efforts between the centres has taken the form of one centre outposting one or more of its staff members in another centre, the arrangement being governed by a memorandum of understanding. In such cases the loyalty of the staff member is to her/his centre, and the relationship is mainly 'additive', instead of 'interactive'. More 'organic' relationships, where the parties to the collaboration feel as 'one', are rare.

Obstacles to forming organic relationships are many: separate mandates, loyalties, accountabilities, funding arrangements, ownership concerns, status/domination concerns, compatibility of partners, etc.

During our final visit to IRRI we were informed of a new approach to inter-centre collaboration which appears to address many of these obstacles. The new model concerns the strengthening of existing collaboration between IRRI and CIMMYT in Rice-Wheat research and reflects the current thinking of the managements of both centres.

Organizationally, the idea centres around creating a project team which would work with a great deal of autonomy in addressing strategic ecoregional research issues in the irrigated rice-wheat production systems in south Asia. The effort would be under the overall supervision of the two DDGs-Research of IRRI and CIMMYT (probably in a rotating fashion). The project would have an institutional identity of its own, with its own full-time staff. The collaborating institutions would pool their funds to provide the financing required and provide scientific backstopping as necessary. One of the centres would provide the legal/institutional umbrella for hiring staff and setting up the team. The team would establish linkages and research networks with NARS and other institutions as necessary.

While the details are still being worked out, including alternative funding mechanisms, it appears to the Panel that organizational models such as this should be encouraged by the CGIAR. Finding workable models to carry out ecoregional research will require tapping fully the ingenuity of the centres. There would be value in orienting the System's incentive structures towards identifying truly collaborative strategic research initiatives among centres, NARS and their research partners.

We applaud IRRI and CIMMYT for their efforts geared towards improving inter-centre collaboration in strategic research.

4.8 Conclusions on Research Management

IRRI deserves full praise for organizing its research programme using a matrix management system. We are very impressed with IRRI's (and its DG's) dogged determination to make the matrix system work. IRRI's is perhaps the most ambitious effort within the CGIAR in matrix management and, as such, offers many lessons to other centres contemplating a change towards this type of research management system.

A matrix organization, by definition, is built on a principle of tension between two competing aims and dimensions: relevance of outputs and quality of inputs. Because of this inherent characteristic, it would have been surprising had the Panel found no problems in the running of IRRI's matrix system. Indeed, this would have been a sign that IRRI, in actuality, was not operating in a matrix mode.

As we had expected, IRRI is an extremely dynamic institution. Staff care about IRRI and the way it functions. The staff's awareness of organizational issues (and possible solutions) is extremely high. These have led to the many healthy debates throughout the Institute for improving the way IRRI is managed.

We have made several organizational suggestions above which IRRI should consider for improving the effectiveness of its research programmes. We should note, however, that these do not imply a radical departures from IRRI's current organizational model.

CHAPTER 5 - INTERNATIONAL PROGRAMMES

5.1. Introduction and Overview

The International Programmes at IRRI have a dual objective: to strengthen NARS rice research capacity, and to provide valued services to the international rice research community. The role of strengthening national rice research systems has been played by IRRI since its establishment. It has done this through training and other knowledge-sharing activities including scientific publications, conferences and workshops, collaborative networks and joint development of country and regional projects. These activities are regarded as necessary in achieving the goals of the CGIAR because (a) countries with weak research systems face difficulties in raising production; (b) improved rice technologies developed at IRRI are of limited value unless national programmes have the capability to test and adapt them to local conditions; (c) strengthened national rice research systems can more easily address many rice problems through their own research efforts and through collaboration with IRRI and other IARCs or other NARS; and (d) IRRI can help solve regional problems more easily and in relatively less time through collaboration with strengthened national rice research systems.

Major services provided by IRRI to the rice research community through its International Programmes are those that are linked to IRRI's role as the global centre for rice germplasm, and for knowledge on all aspects of rice research, science and technology. These services are unique to IRRI for which it carries an explicit and full responsibility.

The International Programmes at IRRI are headed by a Deputy Director General, and the activities are implemented through 18 projects organized through five programmes: Germplasm Conservation, Evaluation and Dissemination; Information and Knowledge Exchange; Training; Networks; and Country and Regional Projects (Table 5.1). Each programme is headed by a Centre Head, and each project has a project coordinator. The seed Health Unit is also part of the International Programmes, reporting directly to the DDG. Activities of the International Programmes are managed outside the research matrix through a line departmental structure, with some inputs from the disciplinary divisions (Table 5.2). For 1983, International Programmes are expected to be supported by a total of core and complementary staff of 37.44 IRS and 211.3 headquarter NRS.

Table 5.1 IRRI Projects by International Programmes, as of September 1992

No.	Project code	Title
	<u><i>Germplasm Conservation and Dissemination</i></u>	
1	GC-1-1	Conservation of rice genetic resources
2	GC-1-2	International Network for the Genetic Evaluation of Rice (INGER)
	<u><i>Information and Knowledge Exchange</i></u>	
3	ID-1-1	Improved library services
4	ID-2-1	Improved publication of research results
5	ID-2-2	Copublication of IRRI material
6	ID-3-1	Improved rice database and database information services
7	ID-4-1	Conferences and workshops
8	ID-5-1	Public awareness
	<u><i>Networks</i></u>	
9	NT-2-1	International Network on Soil Fertility and Sustainable Rice Farming (INSURF)
10	NT-2-2	Asian Rice Farming Systems Network (ARFSN)
11	NT-2-3	Integrated Pest Management Network (IPMN)
	<u><i>Training</i></u>	
12	TR-1-1	Improved management of degree and nondegree training
13	TR-2-1	Improved management of group training
14	TR-2-2	Courseware development
15	TR-2-3	Course transfer/Collaborative training
	<u><i>Country and Regional Programmes</i></u>	
16	CR-1-1	Country and Regional Projects in Asia
17	CR-2-1	Country and Regional Projects in Africa
18	CR-3-1	Country and Regional Projects in Latin America and the Caribbean

Table 5.2 Staff Allocation by Division and Programme - Estimate for 1993

INTERNATIONAL PROGRAMMES																																	
Division/Centre	Genetic Resources Centre						Seed Health Unit			Information Centre					Network Coordination					Training Centre				Country Regional Projects				Total International Programmes					
	IRS			Sub-	NRS		IR	Sub-	NRS		IRS			Sub-	NRS		Sub-			NRS		Sub-			NRS	IRS				Sub-	NRS		
	Core	Comp	VS	PD	Total		PD	Total		Core	Comp.	VS	Total		Core	Comp.	PD	Total		Core	PD	Total		Core	Comp.	Total		Core	Comp.	VS	PD	Total	
Social Sciences																		3.80						0.10		0.10	1.10	0.10				0.10	4.90
Plant Breeding, Genetics & Biochemistry			0.10		0.10																								0.10		0.10		
Plant Pathology																								0.05		0.05		0.05				0.05	
Entomology																																	
Agronomy, Physiology & Agroecology															0.05		0.05							0.20		0.20		0.20	0.05			0.25	
Soil & Water Sciences																						0.30										0.30	
Soil Microbiology																																	
Agricultural Engineering																																	
Research Support																																	
Genetic Resources Centre	1.35			2.00	3.35	60.60																					1.35			2.00	3.35	60.60	
Seedhealth Unit							1.00	1.00	11.00																					1.00	1.00	11.00	
Information Centre										5.90		0.92	6.82	72.70													5.90		0.92		6.82	72.70	
Network Coordination	1.85				1.85										1.85		1.00	2.85	23.60								3.70			1.00	4.70	23.60	
Training Centre																				2.00	0.07	2.07	32.00					2.00			0.07	2.07	32.00
Country Regional Projects																								4.60	14.40	19.00	6.00	4.60	14.40			19.00	6.00
Total	3.20		0.10	2.00	5.30	60.60	1.00	1.00	11.00	5.90		0.92	6.82	72.70	1.85	0.05	1.00	2.90	27.60	2.00	0.07	2.07	32.30	4.95	14.40	19.35	7.10	17.90	14.45	1.02	4.07	37.44	211.30

5.2 Germplasm Conservation, Dissemination and Evaluation

This programme is operated by the Genetic Resources Centre (GRC) through its two units, the International Rice Germplasm Centre (IRGC) and the International Network for Genetic Evaluation of Rice (INGER). It is concerned with maintaining the rice genepool through the long-term conservation of cultivated and wild rice germplasm, and with widening the genetic base of rice varieties around the world through the international exchange and evaluation of rice germplasm in multi-location trials. In the past INGER activities were carried out under the Networks Programme. In July 1991, INGER became part of GRC.

5.2.1 Evolution and Current Focus

IRGC: The International Rice Germplasm Centre (IRGC), was reorganized in 1983 from IRRI's Genetic Resources Programme, and was designated as one of IRRI's Global Research Services. Its primary functions are: collection, characterization, documentation, conservation and dissemination of rice germplasm. IRGC also provides training and technical assistance to national and regional genebanks.

INGER: The International Rice Testing Programme (IRTP) was initiated in 1975 as part of the Genetic Evaluation and Utilization Programme (GEN). Ever since its inception, IRTP, funded mostly by UNDP, has served as a powerful research tool, strongly linking IRRI and NARS.

IRTP was launched to organize a low-cost global network of systematic collection, distribution and testing of rice genetic materials. To provide an effective regional focus, IRTP in 1984 was organized into IRTP-Asia, IRTP-Africa, and IRTP-Latin America and the Caribbean. IRTP-Africa was established in 1985 as a joint project of IRRI, IITA, WARDA and the national rice research systems in Africa. The coordinator for IRTP-Africa has been located at IITA and for IRTP-Latin America at CIAT. The global coordinator located at IRRI also serves as coordinator for IRTP-Asia.

In 1989, IRTP was reorganized as INGER to reflect the full scope of the activities, and with the objectives of making the world's elite germplasm available to rice scientists, and providing them an opportunity to assess the performance of their own breeding materials over a range of environments. However, a fifty percent reduction in funding for the 5-year period starting July 1991 forced INGER to reduce the number of evaluation nurseries and the testing sites it could handle.

The structure and mission of IRGC and INGER were peer-reviewed in 1991. The review recommended against merger between IRGC and INGER because of the short term activities (packing nurseries for specified delivery dates) of INGER and the long term nature of IRGC activities.

5.2.2 Achievements and Impact

It is an established fact that NARS regard the activities of IRGC and INGER as one of the major strengths of IRRI. This was confirmed through a

questionnaire survey of NARS world-wide (Appendix IV). Analysis being conducted by IRRI in collaboration with Yale University to quantify the flow of genetic material, and the information about their characteristics, from IRGC and INGER clearly show that IRGC has been responsible for increasing the pool of landrace materials and the use of INGER nurseries by national programmes. These in turn have caused an increased volume of flow of varieties, and have led to a high aggregate number of released material.

This achievement also reflects the fact that the germplasm activities of GRC benefit from their strong links with research activities related to genetic enhancement and breeding, as well as other research activities (Table 3.1). For example, currently 0.65 IRS time is spent in a project on genetic characterization of conserved germplasm located in the cross-ecosystems programme (Table 3.2).

IRGC: Capacity to effectively handle large volume of seed samples has been a hallmark of IRGC which received 2,930 seed samples during 1991, bringing the total number of accessions for the different categories to : *O. sativa*, 74,000; *O. glaberrima*, 1,300; wild species, 1,900; and genetic testers and mutants, 20. This represents the largest international collection of rice germplasm.

The Panel notes that there have been significant improvements in the efficiency of the Centre brought about by recent changes in handling operations and upgrading IRGC's technical standards. For example, seed production and rejuvenation activities are now limited to dry season cultivation. Similarly, computerized labelling of seed packets, and pre-packing of 10 g seedlots for distribution have significantly increased germplasm distribution efficiency.

To improve the accessibility of germplasm information contained in the GRC database, a revised version of IRRIGEN (a micro-computer based rice germplasm software) was released to national programmes in Asia and Africa, and information on IRGC accessions is now accessible electronically directly through appropriate communication systems. The database files and their management are currently under review in order to modify the structure for cross compatibility between files and to enhance electronic access to the computerized data.

INGER: INGER today is the largest single pathway for distributing, exchanging and testing new rice varieties and breeding lines world-wide. Available evidence show that 17.2 percent of rice varieties released in the indica regions of the world were crossed at IRRI. In 1980s, 23.5 percent of the area was planted with these IRRI varieties. In addition 30.8 percent of the released varieties had at least one IRRI parent and an additional 6.3 percent had at least one IRRI grandparent. The enormous importance of borrowing as a strategy for the development of modern varieties is borne out by the fact that since 1970, less than 8 percent of the new varieties have been 'pure' national developments. The most significant contribution of genetic resources has been through the use of IRRI germplasm as parents, and while these were not channelled through INGER prior to 1975, in recent years it has been the biggest single channel for developing new varieties facilitating the use of IRRI parent lines taken from INGER. The Panel commends IRRI for the creation of this enabling rice germplasm environment

through the INGER mechanism. Indeed, since 1981, more than half of the released varieties (400 out of 797) have either been borrowed through INGER or were bred from parents borrowed from INGER. This is, by any measure, an extraordinary achievement, and IRRI and its national collaborators deserve full credit and recognition.

A large amount of valuable information has been generated through INGER on biotype and race differences among major pests and pathogens, on location-specific resistance genes, and on interaction of rice and major weather factors, which helped in the construction of simulation models.

1985 was a record year in seed distribution (Fig. 5.1) when 1,707 sets of 30 types of nurseries (composed of a total of 2,736 entries) were sent to 62 countries. In 1991, the figures for nursery distribution were: 856 seed sets of 25 types (composed of 1,927 entries) to 49 countries. During the 18 years of operation, a total of 37,143 entries (including some yearly repetition) were evaluated through 25-30 types of nurseries at about 600 test sites in different ecosystems, and 231 entries originating from 29 countries and 3 IARCs were released to farmers in 55 countries.

INGER has allowed international seed exchange to be made unhampered by political restrictions, which was originally possible only via IRRI. This major achievement together with the joint monitoring site visits involving NARS and IARC scientists, are services that are highly valued by NARS.

5.2.3 Assessment

It is the Panel's view that INGER, with its sharper focus on germplasm and environmental characterization, has brought a greater level of effectiveness in IRRI's germplasm exchange and evaluation activities. INGER has made the germplasm exchange and evaluation activities more demand-driven, and less supply-driven. INGER has enhanced the possibilities for targeting germplasm material. Some of the decrease in the number of seed sets and types of nurseries in the recent years can be explained by this increase in effectiveness. However, the Panel is greatly concerned to note that since July 1991, INGER activities have had to be reduced because of the 50 percent reduction in funding. The Panel encourages IRRI to make every effort to mobilize the required resources to protect the integrity and the worldwide effectiveness of INGER.

We highly commend IRRI's efforts in collecting wild species of rice. Considering the anticipated frequent utilization of genes of wild rice species in the future both in conventional breeding and in gene transformation, IRRI undoubtedly needs to continue this effort, in cooperation with NARS.

The strategy adopted by INGER to conduct its coordinated field trials through NARS has played a significant role in linking IRRI and NARS, and in the rapid identification of promising germplasm and cultivars. This has brought increased effectiveness in the evaluation and dissemination processes of INGER, which is commendable. In general, however, the potential value of a germplasm collection is based on the extent and accuracy of its characterization with respect to cytological,

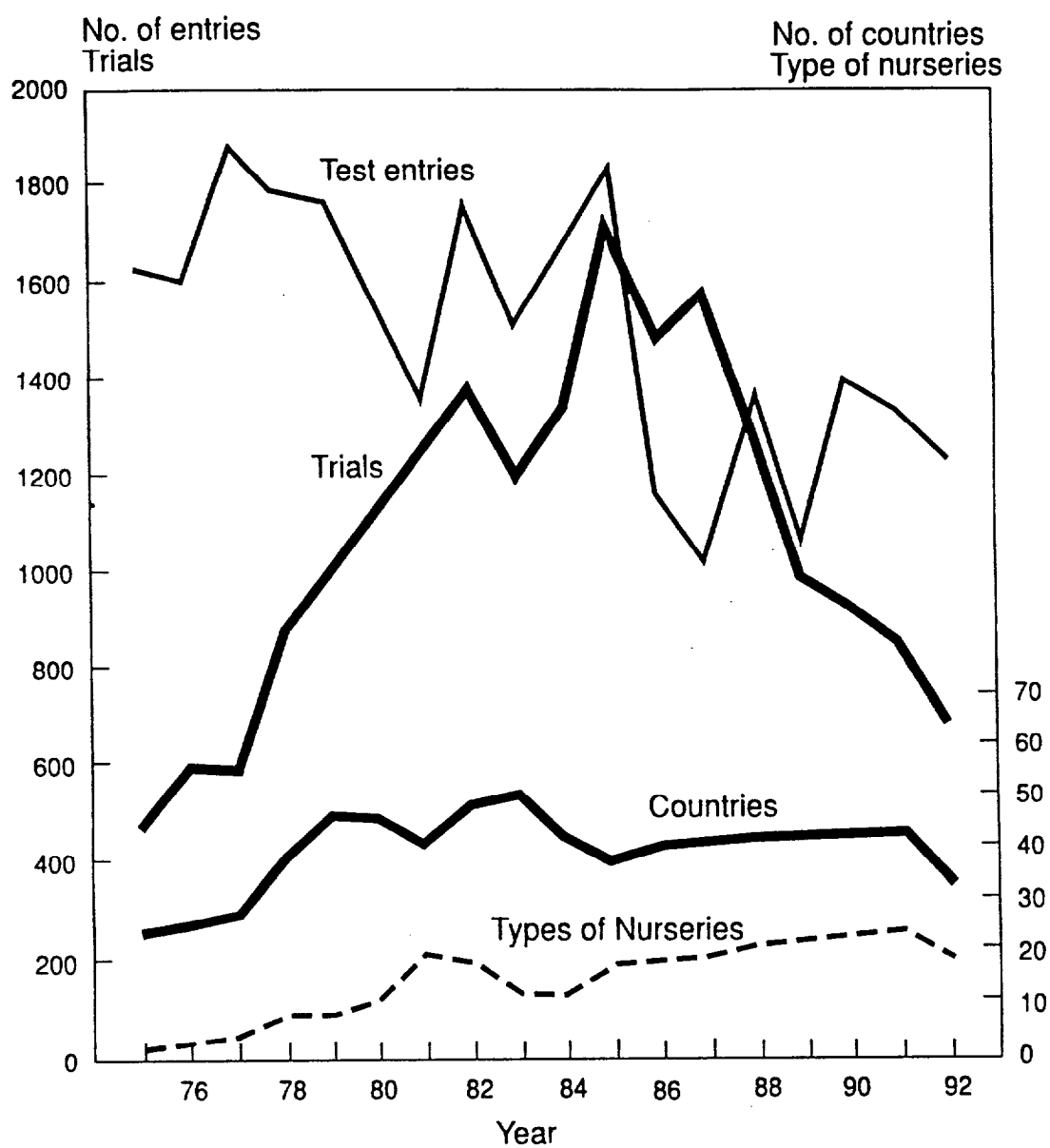


Figure 5.1. Trends in INGER global nurseries, 1975-92.

physiological and agronomical traits and habitat. The Panel strongly encourages GRC to ensure that germplasm related site information is collected as a matter of routine so that the overall information can be useful in formulating research activities in germplasm conservation and utilization.

Further, because INGER can supply significant amounts of data on the existence of biotypes and races or genotype-environment interactions, the comprehensive information that could be obtained from INGER is also valuable for constructing databases for the GIS and other networks. The Panel commends the efforts that are underway to consolidate the inventory of seed stocks and databases.

As the purposes of IRGC and of INGER differ markedly, the Panel agrees with the conclusion of the peer review that they should be retained as separate and distinct activities. The whole process from preparation of entries to shipment in INGER is different from that in IRGC, but some parts of data analysis, including chemical analysis can perhaps be conducted with one set of facilities. The Panel concurs with the decision to house the two functional units within GRC but wishes to clearly emphasize that IRGC and INGER represent two of the largest global core responsibilities of IRRI whose integrity the Institute can least afford to jeopardize.

Recommendation 5.1

The Panel recommends that IRRI make every effort to mobilize required resources to protect the integrity and the worldwide effectiveness of INGER and to maintain the high level of management capability required for INGER's success.

5.3 Information and Knowledge Exchange

In this section we comment on IRRI's programmes in scientific communication and publishing services (CPS), the library, and public awareness. Non-library databases are covered in Section 6.8 and computer services in Section 8.6. On IRRI's organization chart, the public awareness function reports directly to the DG while communication and publications, and library and documentation services, are part of the Information Centre which reports to the DDG for International Programmes. The person handling Public Awareness also serves as the Information Centre Head and the unit within the Information Centre that addresses scientific communication. Thus in the public awareness capacity he reports directly to the DG and in the capacity of head of the Information Centre he reports to the DDG for International Programmes.

During the period under review, funding for each activity remained in approximately the same proportions. As we look out ahead at 1992 and 1993, we see a major increase in the allocation of resources for public awareness.

5.3.1 Scientific Communication and Publications

Since 1987 output of this unit has remained fairly constant as can be seen from Table 5.3.

In 1991, IRRI published its first 'electronic book' a computer readable edition of *Publications in the International Agricultural Research and Development Centres*. The Research Paper Series ceased publication at the end of 1991 with the expectation that, in the future, these types of papers would either be published in the journal literature or in a briefer form in the *International Rice Research Newsletter*. Three newsletters ceased publication: the *Integrated Pest Management Newsletter* (in 1987), the *International Azolla Newsletter* (in 1989), and the *Deepwater Rice Newsletter* (1990). One newsletter was begun, the *IRRI Hotline*, a newsletter about IRRI achievements, aimed at decision-makers in the donor community.

Table 5.3 IRRI Publications: 1987-1991

	1987	1988	1989	1990	1991
Total Books	17	15	17	10	17
Books co-published in multiple language editions	4	4	6	5	4
Research Paper Series	8	6	2	6	7
Newsletters	7	7	7	5	8

A study of the audiences of IRRI scientific publications, and their expectations over the next 10 years has been undertaken by an IRRI research fellow. A Peer Review of the Communication and Publication Services unit, carried out in November 1991, commended CPS for this "extremely productive operation, turning out high quality, relatively low cost, first-class materials".

The Panel is concerned about what appears to be declining resources allocated to scientific publishing and communication. Between 1990 and 1993, the budget for CPS is planned to decline from US\$553,000 to US\$396,000 in nominal dollars. In 1993 *International Rice Research Newsletter* will be renamed to *International Rice Research Notes* and reduced from six to four issues a year, to reduce mailing costs. IRS editors on board in CPS have been reduced from 3 to 2, and these positions are being used increasingly for producing quick turn-around public awareness material rather than for scientific publishing. While recognising the significance of public awareness activities for the future of IRRI, they should not be at the expense of scientific communication support. Throughout our report we have made suggestions for improving IRRI's effectiveness in science. We are concerned that the current capacity in scientific communication and publishing will be insufficient to meet IRRI's needs. Consequently, the Panel urges IRRI make every reasonable effort to ensure that adequate resources

are devoted to scientific publishing and scientific communication activities required by its research programme.

5.3.2 Library

IRRI is the only CGIAR centre to have the provision of a global information service for any interested scientist as part of its legal mandate. The Articles of Incorporation state as one of IRRI's organizing objectives "To establish, maintain and operate an information centre and library which will provide, among others, for interested scientists and scholars everywhere a collection of the world's literature on rice". As the volume of agricultural literature has increased, and storage and transmission technology capabilities advanced, the library's mission could be viewed as moving from an emphasis on ownership to one of access to information, with increased attention to service.

The IRRI Library is the major world repository of rice literature. The collection consists of monographs, serials, maps, microfilm, a clippings collection, English translations of some journal articles, and a reprint collection of articles on rice, published in journals not held by IRRI. The library compiles the International Bibliography of Rice Research and its bi-monthly supplements, published as the *Rice Literature Update* and available in machine readable form. A wide array of relevant indexing and abstracting services are available, increasingly in the CD-ROM format. The library provides traditional library services such as circulating materials, lists of acquisitions, photocopying, interlibrary loans, and literature searches. Within IRRI, photocopies of tables of contents are circulated. The catalogue of holdings is automated, but available only to users on the IRRI LAN or by modem. Online Public Access Catalog (OPAC) terminals are not available for use in the library. The library is crowded, poorly laid out, has no signage, and is heavily used as a study hall for UPLB students. It has limited service hours and fire protection.

At the same time, IRRI has an extremely valuable resource of rice information. The challenge now is to organize the library's activities and resources, through automation, in such a way that they can be exploited more effectively by researchers and students. With information now available in machine readable forms, it can be searched and packaged so that the information provided the user is relevant and precise. The library must become more active in identifying specific market segment needs, developing products and services such as the selective dissemination of information, and promoting the availability of the Library's services and resources. In the country visits, the Panel learned that few scientists are aware of the information resources available to them from IRRI; they assumed that only IRRI-published items were available. As noted in Section 5.4.2 the panel suggests that the Library collaborate with the Training Centre to produce a module on library resources and services to be used as part of training courses already being offered by IRRI. A beginning has been made in automating library operations and services as a result of a consultancy review in early 1989; more remains to be done. The Panel suggests that a consultancy review of the entire library services and operations would be useful.

The worldwide library environment has changed markedly even over the past ten years. It is critical that the Head of the Library be linked with international colleagues who face similar challenges and who can collaborate on shared solutions. Because of rising costs, libraries no longer have the luxury of functioning as isolated islands whose main functions are to collect, organize and preserve collections. The Panel is aware that discussions are taking place about how the library should be staffed, at such time as the present Librarian retires. In filling the position soon to be vacated, the Panel urges that the successor is professionally qualified to play a leadership role in international fora on information service and management issues, in addition to managing an international library centre using the most up-to-date approaches and technologies.

Recommendation 5.2

The Panel recommends that, in replacing its retiring librarian, IRRI employ a professional who has demonstrated competence as an international leader in the diverse areas of library and information services management.

5.3.3 Public Awareness

IRRI has developed a broad range of public awareness activities over the years. In the review period, it has issued a frequent stream of news releases; conducted IRRI Press Days; hosted a steadily increasing stream of journalists (46 in 1989, 108 in 1990, and 150 in 1991); been the subject of major television programmes in the Philippines, Australia, Canada, and the U.S.A.; educated approximately 30,000 visitors (mostly school children) a year; developed and revised the multi-media presentation *Rices in IRRI* that is shown to these visitors; published nine country booklets in a series called *Facts on Cooperation*; and begun publication of the *IRRI Hotline*, a compilation of IRRI's achievements aimed at donors.

It is not surprising that the peer review team in 1991 affirmed that IRRI "has a public awareness programme comparable to the best of any similar research organization".

As we look ahead, the Panel notes the major increases in public awareness funding at IRRI. Funds spent in 1991 were US\$100,000, while in 1992 US\$220,000 was budgeted but estimates are that US\$400,000 will be spent, and in 1993 US\$440,000 is planned. While we are fully sympathetic with the importance of public awareness activities to the future of the CGIAR Centres, this seems to be an extraordinarily rapid rise.

5.4 Training

The mission of IRRI's training programme is to enhance NARS capacity for rice and rice-related research through collaboration with national research systems including universities, and other institutions.

5.4.1 Participant Statistics

Since the inception of the training programme in 1962 more than 7,000 scientists and technicians have participated in training and professional advancement programmes. Of this number 2,577 were trained or on board during the period 1987-1991, in the categories shown in Table 5.4.

The previous review recommended that greater emphasis be given to training Ph.D. students since many countries were developing their own capacity to provide M.S. level of instruction. Table 5.4 illustrates the relative increased emphasis on Ph.D. candidates; in 1987 the percentage of Ph.D. to M.S. plus Ph.D. candidates was 52 percent, by 1991 it had increased to 68 percent.

Almost 90 percent of the participants came from Asian countries; the distribution by country within that 90 percent is shown in Figure 5.2.

Table 5.4 Categories of Participants : 1987-1991

CATEGORY	1987	1988	1989	1990	1991	TOTAL
Research Fellow*	45	32	62	51	41	231
Visiting Scientist*	19	19	8	5	-	51
Ph.D. Research*	89	83	107	86	82	447
M.S. Research	81	55	57	39	39	271
Non-Degree (OJT)	55	36	39	41	33	204
Group Training	355	269	181	282	286	1373
Total	644	494	454	504	481	2577

*These figures reflect the number of participants in these categories each year. Thus the same research person may be indicated in more than one year.

During the period under review the proportion of female participants increased slightly each year in all categories except Visiting Scientist. In 1991 women comprised 17 percent of the participants compared with 10 percent in 1987. The percentage is still low for Group Training (15 percent in 1991), the largest training category. The Panel recognizes that participants for these courses are selected based on the recommendation of the NARS, not by the IRRI/TC. Nevertheless, strategies for increasing participation by women in this category can be developed. One approach would be to set aside a designated number of slots for women, to be nominated by the NARS.

The 1987 Panel recommended that "to the extent possible encouragement should be given to those postdoctoral candidates who have thesis work in first-class universities and that Fellowship selections should be made with a view of bringing fresh ideas to IRRI". We have reviewed the list of institutions from which IRRI research fellows graduated between 1987 and 1991, and note that many came from prestigious

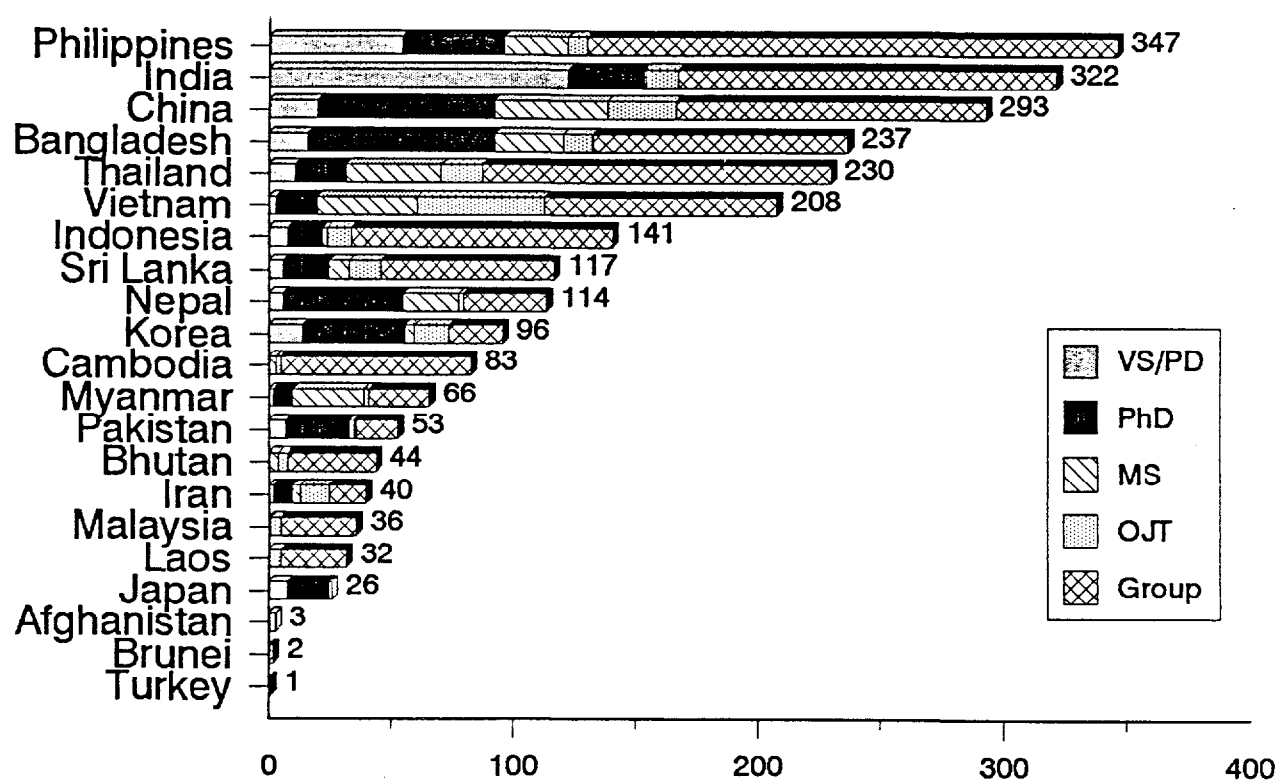
universities. During the five-year time period, the candidates were recruited from 13 countries and 43 institutions (Table 5.5).

5.4.2 Current Programme and Future Direction

The IRRI Training Centre itself is responsible for five regular courses. The remaining courses are designed in the Divisions, supported by one person seconded from the Training Centre to each course to assist in instructional design and in the preparation of course materials.

Support courseware includes performance objective manuals, guidebooks and handbooks, basic skills development booklets, slide-tape modules, interactive computer assisted instruction, video-instruction, and glossaries. The development of appropriate courseware is even more critical for the presentation of in-country courses and the transfer of courses to the NARS. More comprehensive Trainee Manuals and Instructor Manuals are being developed and will be pilot tested in the joint Thai/IRRI rice production research course later this year. Illustrative of the priority being given to courseware development has been the recent appointment of a courseware specialist and the array of 48 courseware titles produced.

Figure 5.2 IRRI Trainees - Asia : 1987-1992



A challenge for many IRRI trainees is that most published scientific research and almost all IRRI training programmes are in English. This handicap was expressed to us in our country visits and noted in an internal assessment of the Training Centre. To assist participants, an ESL (English as a Second Language) Learning Facility was established at IRRI in 1991. The unit assists IRRI scholars and trainees improve their English proficiency skills and is responsible for organizing and implementing technical writing courses to assist scholars in improving their scientific writing skills.

The Learning Centre has a small but useful library. As with other holdings scattered throughout IRRI, we suggest that the records and location for these items be included in the IRRI Library catalogue so that their availability is apparent to all potential users.

As evidenced by the NARS survey (Appendix IV), IRRI's training programmes have been well received and are expected to become even more important over the next five years. IRRI's courseware, an integral element in its group training activities, has been of good quality and will become even more crucial as IRRI continues to decentralize certain training activities to the NARS and to its consortia partners. We urge that the positions supporting this function be filled, if necessary by persons not limited to internally available staff at IRRI.

Table 5.5 Source of Research Fellows : 1987-1991

COUNTRY	NO. OF INSTITUTIONS	NO. OF FELLOWS
India	15	24
Philippines	2	12
U.S.A	8	12
England	4	4
Japan	3	3
Egypt	2	2
Germany	2	2
Hungary	2	2
China	1	1
Korea	1	1
France	1	1
Bulgaria	1	1
Pakistan	1	1
Total	43	66

IRRI's evolving strategy in training is to develop more specialized training programmes at IRRI while assisting the national systems to develop their own applied production courses. More training is being shifted away from Los Baños to national programmes to increase indigenous national training capacities. This is being achieved by providing a Training and Technology Transfer course which 'trains the trainer', and by providing IRRI-developed courseware that can be readily transferred, adapted, and translated. Examples of this approach are the recent courses done in Cambodia (conducted in the Khmer language), Myanmar, Bangladesh, and Bhutan. Table 5.6 shows the increase in 'in-country' training programmes.

As IRRI decentralizes/devolves training to locations away from the IRRI campus, it will be important for participants to have a good understanding of IRRI's resources that are available for their use at Los Baños. IRRI's mandate includes the "operation of an information centre and library which provides to interested scientists and scholars a collection of the world's literature on rice". Almost no scientists or researchers we visited in the country programmes were aware of their ability to use IRRI's information services, apart from the receipt of books and pamphlets actually published by IRRI. The Panel suggests that the Training Centre, in collaboration with the Library, develop a brief module on the role of published information in the research process, and the resources and services available from IRRI's Library. This courseware could be in the form of a video or slide/cassette programme that could readily be personalized to the language of and/or country where it is being shown. It would be used as part of existing training courses.

Table 5.6 In-Country Training Programmes

	No. of Courses	No. of Participants	No. of Countries
1987	3	54	4
1988	-	-	-
1989	2	78	2
1990	3	130	3
1991	7	211	2
1992	8*	156	5

*Year-to-date, August 1992

In 1991, IRRI hosted a collaborative workshop for key officials from designated rice research institutes and universities in Asia, to identify regional priority training needs and strengths of participating NARS, universities, and institutes. The objective was to develop a regional rice research training programme involving collaboration and division of labour in offering short-term group training. The intent of this workshop was to further accelerate the pace of decentralization/devolution of training activities.

At the same time, as IRRI is moving away from a prior emphasis on offering applied production courses itself, it is moving toward developing more specialized 'upstream' programmes at Los Baños, dealing with the application of new knowledge in such areas as biotechnology and environmental sustainability in different rice ecosystems. In the past several years, the following courses have been developed and offered at IRRI:

- Rice Biotechnology;
- Hybrid Seed Production;
- Geographic Information Systems;
- Simulation/Systems Analysis in Rice Production;
- Quantitative Methods in Pest Ecology;
- Biological Control.

This dual approach makes sense to the Panel.

In 1991, the Training Centre initiated a 2-year impact study of its M.S./Ph.D. training programme and this year has begun a similar study of its group training programmes. No findings are available yet.

5.4.3 Assessment

The Panel judges the Training Centre to be an effective, well-directed asset for IRRI's central missions of research and institution building. The lessons learned from decentralization are being assessed in on-going studies and being reflected in future training planning. The Panel was pleased to read the thoughtful document recently prepared for the IRRI Board on *Decentralization and Devolution of IRRI's Short-term Group Training: Progress, Lessons Learned, and Future Direction*. The Training Programme has recently been subject to an internal review. That assessment was positive and the recommendations made have been accepted by management.

We support the direction the Centre is taking in supporting IRRI's strategy and applaud the careful attention it is giving to learning from experience.

5.5 Networks

5.5.1 Evolution and Current Status

IRRI, like all CGIAR Centres, uses networking as a mechanism to bring together scientists from different countries and disciplines to work together. IRRI's relationships and interactions with the NARS of rice growing countries have evolved over the last 30 years. The nature and type of interactions have changed as the national

systems have gained expertise and resources; as the scientific community has gained access to new knowledge, tools, training, concepts and communication techniques, and as the international rice research agenda has changed in response to new demands.

Early networking interactions with national programmes focused on disseminating, verifying and adapting new technologies to improve the productivity of irrigated rice. As the scientific capacity in many national programmes strengthened, collaborative research activities involving both IRRI and national scientists were undertaken. At present IRRI's international Programmes include three networks (others are housed in Research Programmes and have been discussed in Chapter 3).

5.5.2 Asian Rice Farming Systems Network (ARFSN)

This Network originated in 1975 as part of the Multiple Cropping Department, and was called the Cropping Systems Network, which was changed later to its current name as a result of the inclusion of livestock and fisheries into the set of activities covered by the Network.

When it was initiated, the goal of the ARFSN appears to have been more ambitious than seems to be the case now. It was part of what was then a new trend to promote inter-disciplinary research using systems approach. IRRI's Department of Multiple Cropping was the main proponent of this line of activity. While the approach has yielded little in terms of research output, it did contribute to the development and refinement of the methodology of conducting on-farm trials and facilitate the exchange and evaluation of useful cropping systems and farming systems practices.

In line with the thinking at the time it was started, ARFSN is a vehicle used by IRRI to promote collaborative work with NARS, and to further interdisciplinary work among NARS scientists. The Institute had no trouble finding collaborators from among the NARS scientists, growing now to 70 collaborating institutions in 18 countries. Indeed, the network has continued to grow, despite the admonition of the Third External Panel Review that it should cease expanding. The promotion of interdisciplinary work among NARS scientists has never been successfully achieved, however, in part because the structure of the public research systems among the NARS allows for very little interdisciplinary work. In particular, NARS have very few social scientists, who are usually essential collaborators in the effective conduct of most farming systems studies. ARFSN has however extended assistance to a number of NARS in Asia in establishing national farming systems programmes.

Unfortunately, shortage of needed disciplinary skills seemed to have afflicted ARFSN inside IRRI as well, but in the opposite direction. The Network appears to have lost its connection with the mainstream biological research programmes of IRRI almost altogether. The Network received a major input from the late John Flinn from the Agricultural Economics Department, who was a dedicated farm-management economist. However with his departure, the Network (minus the Women in Rice Farming Systems project, about which more below) no longer is linked closely to the Social Sciences Division.

Without a rigorous intellectual input from the research programmes, the ARFSN has continued, concentrating on evaluation of various cropping patterns, the impact resulting from the introduction of new cropping patterns, and the identification of promising cropping patterns. In terms of the language used by present management, it evaluates 'technologies', technologies being conceived of as specific packages of farming practices - defined primarily by the cropping pattern.

The main output of the Network has been a series of workshop proceedings, which report on its activities. There has been some interchange among the Network participants of the various cropping patterns evaluated. Although vast amounts of cost and return, and income- and nutrition-impact data were collected, the Network has never developed a systematic approach to the collection and storage of comparable data sets, so that it has not been able to conduct a useful comparative study of the vast array of farming systems that it has studied. Nor has there been any attempt to examine the resource impact of the cropping system. The benefit to the participating NARS in recent years appear to have been marginal. The survey of the NARS indicates that their leaders do not rank ARFSN very highly as a useful contributor to their work (Appendix IV).

The NRSs in the Social Sciences Division and a visiting scientist have been working on an impact study of ARFSN, but no output has yet emerged from this project. We understand that the current head of the Social Sciences Division is finalizing the project.

ARFSN also has as one of its components the *Women in Rice Farming Systems* (WIRFS) project. This component is discussed fully elsewhere (see Section 6.6). It suffices here to note that other than sharing the research sites and the administrative structure in IRRI, there are relatively little substantive relations between this component and the rest of the ARFSN. The future of WIRFS can therefore be detached from that of ARFSN.

5.5.3 International Network on Soil Fertility and Sustainable Rice Farming (INSURF)

The Network on Soil Fertility and Fertilizer Evaluation for Rice (INSFER) was initiated in 1976 with the main objectives of improving and maintaining fertility to sustain high yields. The network was renamed the International Network on Soil Fertility and Sustainable Rice Farming (INSURF) in 1988, the new name being intended to reflect additional concerns such as sustainable agriculture and environmental quality issues.

The major activities of INSURF in the past 4-5 years have included collaborative research on integrated nutrient management through proper use of chemical and biofertilizers, on long-term effects of inorganic and organic fertilizers on soil fertility and productivity, and on nutrient management strategies for adverse soils. Other activities included training, monitoring tours and planning meetings. Nearly 80 percent of the activities have been oriented to the irrigated-rice ecosystem, although the

emphasis is now being also shifted to other ecosystems. The following gives the idea of ecosystem related activities during the period 1987-91.

Activity	No. of Experiments/Field trials (No. of countries involved)
Integrated Use of inorganic and organic N sources	
(i) Irrigated lowlands	78 (8)
(ii) Rainfed lowlands	8 (1)
(iii) Rainfed upland	11 (3)
Long term fertility experiments	
(i) Irrigated lowlands	139 (9)
(ii) Rainfed lowlands	4 (1)
P x lime interaction in acid upland	46 (3)
N - efficiency in irrigated lowlands	14 (5)
Comparison of Hand-and-machine-applied N-fertilizers	8 (4)

The progress and achievements of INSURF were recently summarized in the Terminal Report of its phase 1988-90. The conclusions reflect our own evaluation of the programme: "because of limited information in addition to the agronomic data, it is rather difficult to draw more specific conclusions (from the research reported). Each collaborator should be able to arrive at more relevant conclusions for his own use (than is possible from the data obtained) and to compare his results with other collaborators". A similar concern was stated in the final report of the Peer Review of Networks (1991). It states "while a commendable number of experiments had been executed, scientific rigor was difficult to assure. Thus, the generated data may not have always been fully exploitable".

The last EPR suggested that there should be a closer interaction with ARFSN, particularly at planning stages and through conduct of research at the same sites, and that the linkages of the programme should be strengthened with the soils wing at IRRI. The panel further noted that a number of countries felt that simple fertilizer trials no longer met their needs and that some of the countries could contribute to more in depth studies. It is our assessment, however, that during the past five years there has not been a perceptible improvement in the scientific content of the network. That its practical usefulness to the member countries has been limited is reflected in the low rating that this programme was given by NARS in response to the questionnaire circulated by the TAC Secretariat, and by panel members' discussions with several NARS scientists. Improving nutrient use efficiency and developing integrated nutrient management practices for intensive rice-based cropping systems will be key issues in ensuring sustainability of production and productivity in the major rice ecosystems. To achieve the necessary scientific quality of research on such complex issues would call for a total revision of the existing programmes. Careful selection of representative sites and their characterization, in-depth monitoring of changes due to imposition of well thought out treatments, and adoption of modelling approaches for prediction of long-term effects would provide the kinds of data needed in this important area.

5.5.4 Integrated Pest Management for Rice Network (IPM-R)

IPM, basically, aims to develop the best mix of pest management measures to enhance natural controls and to ensure judicious use of pesticides. The broad perspective of IRRI's pest management research is to address strategic issues that will help fill the knowledge gaps needed to design management options that will promote and sustain low pest populations utilizing the principles of IPM-R. IPM-R Network has the objective to highlight the value of this approach in national programmes; promote interdisciplinary site - specific research and encourage national programmes to develop safer and more economical pest management technology. It was also intended to link IRRI's research with FAO's IPM network that concentrates on extension of technology to the farmers.

IPM-R started in six countries in July 1990: China, India, Indonesia, Malaysia, Philippines and Thailand, and has promoted IPM techniques in accordance with local conditions. Organization of workshops on pest problems of rice including leafhopper, golden snail, white stemborer, brown planthopper and ragged stunt virus and assistance in information exchange are some of the main accomplishments.

In the future, it is proposed to encourage and support country IPM teams to conduct research on issues identified in the diagnostic workshops.

In a recent Peer Review of the activities of the Networks it was observed that research results from IPM-R are very site/region specific and there were little chances of the results being transferable to other ecosystems.

We consider that in the future the research component of the Network activity needs to be emphasized and minimum data sets required for extrapolation of research results collected. At IRRI the Network should have strong links with concerned divisions such that these links can also provide a valuable feedback to the IRRI scientists.

5.5.5 Assessment

Two of the networks, ARFSN and INSURF, in the Panel's judgment, have been good and useful enterprises in the past, but for reasons stated earlier, are not currently accomplishing work that is of high priority in terms of IRRI's present scientific objectives. From IRRI's point of view, the question arises whether they should be revitalized, modified, or brought to an end.

This is of course not a question for IRRI alone to decide. The two networks are shared enterprises, with many committed national researchers joining IRRI scientists in their work. IRRI certainly has no license to dispose of the networks as it sees fit, and whatever outcome is determined must reflect the views and interests of national researchers as well as IRRI's.

What IRRI must do, however, is to arrive at its own judgment as to whether these networks warrant the continued investment of IRRI time and funds, given

the current severe limits on IRRI's budget and staff, and to provide that judgment to its national researcher colleagues in the networks as they jointly decide what to do next. The panel suggests that the following considerations would be relevant as IRRI addresses this question:

- Since these networks began, IRRI has made a major shift in its approach to farming systems research, moving from the cropping systems model that has guided ARFSN, to an effort to understand and influence farming systems in an ecosystem framework. The latter is a far more complex and scientifically demanding objective.
- Research on farming systems and on nutrient management will certainly be of high priority on IRRI's future agenda for the ecosystem research programmes and the new research consortia. Research networks on aspects of these subjects may be useful in the future. But if so, the levels of scientific sophistication and quantitative rigour that will be needed will be well beyond those that have been built into the present networks. IRRI's own future research, and its collaborative research with national systems, must reflect the quantum jump that has been made in recent years in research methodologies.
- IRRI is thinking of setting up a Crop and Resource Management Network, concerned with the exchange, evaluation, and dissemination of information and technology, into which the technology-evaluation activities of ARFSN and INSURF would be integrated (Programme Report to the Programme Committee of the Board, 21-22 September 1992). The Panel urges IRRI to consider such a move with great care. Unlike INGER, which is built around the concept of testing a highly tangible product - that, germplasm - the new network would be evaluating less tangible and more complex technologies. Surely, IRRI should not begin such an effort without having in hand an array of new and exciting technological advances, ready for exchange and evaluation.
- Moreover, if IRRI were to establish a Crop and Resource Management Network, it would be better to build it anew, rather than by patching existing networks, like ARFSN and INSURF, which were established for different purposes and may not have the mix of participants needed for the new network.

Recommendation 5.3

The Panel recommends that IRRI, together with colleagues from national research systems, seriously consider the future of and IRRI's participation in the two Networks ARFSN and INSURF.

The IPM-R network may be a different story. Unlike the other two, IPM-R is quite new, having been started only in 1990. Moreover, it has had both research and technology exchange purposes. It also has strong ties to the scientists in the relevant research division (Entomology). In view of the importance of the further development of integrated pest management research at IRRI and in the national systems, the Panel raises the question whether the IPM-R might usefully be moved upstream in its research agenda (toward quantitative pest ecology), and be made into a research network akin to SARP, with its home in the Entomology Division. It would then be more concerned with sharing the most modern research methodologies with colleagues in national systems, and less concerned with sharing particular technologies. If this turns out upon examination to be a promising direction to move, we believe that IRRI's funds would be rather better spent than at present, with the chance of a rather larger future pay-off.

5.6 Country and Regional Projects

5.6.1 Background

Country and Regional Projects have two broad objectives: i) to strengthen the capabilities of NARS; and ii) to facilitate and undertake research aimed at generating and disseminating rice-related knowledge and technology. They are funded by bi-lateral agreements (present donors include USAID, CIDA, AIDAB, SDC, IDRC, SAREC and UNDP) and important criteria determining IRRI's involvement are the importance of rice in the countries concerned and the need for upgrading the rice research systems.

A Country Project is focused on a single country. There are currently 9 such Projects involving 15 in-country, resident IRRI scientists. Project size ranges from a team of 3-4 resident scientists (Cambodia, Egypt, Lao PDR and Madagascar) to a single scientist/liaison officer (Bangladesh and Myanmar) or, for small countries, only part of a scientist's time (Bhutan). All Projects have funds to provide backstopping by headquarter scientific inputs.

Regional Projects are a means of supporting several smaller countries whose individual rice research needs do not merit full Country Projects. Liaison Officers attached to IITA and CIAT coordinate regional efforts - primarily INGER - for SSA and LAC, respectively. IRRI has also held discussions to try to establish Regional Projects in Southern Africa (through SACCAR) and in the northern countries of the ECSA region (e.g., Tanzania, Uganda and Burundi). For the WANA region, the IRRI team Project Manager of the Egypt Country Project spends 10 percent of his time on regional initiatives.

5.6.2 Achievements and Impact

In the Country Projects, IRRI's institution building role has ranged from strengthening existing systems to helping to create virtually new systems (as in the case of Lao PDR). It has typically involved assisting in drawing up an overall research strategy; planning and developing the physical resource base, including where necessary

the establishment of new research and training centres and network sites; and developing appropriate research approaches. Training has been a critical part of the institution building process. Training at IRRI has ranged from short courses (for example, 67 scientists from Cambodia) up to postdoctoral level (several of the most senior scientists in Egypt) and there has been a strong commitment to in-country training.

The research supported by Country Projects has commonly been centred on germplasm and varietal improvement. IRRI material is reported to have formed a significant part of the breeding programme in Myanmar, to have contributed to near-release varieties in Madagascar and to released varieties in Bangladesh, Cambodia, Egypt, Vietnam, and Bhutan. Particularly in the larger Country Projects the research has also included aspects such as site characterisation, nutrient management, land and water management, integrated pest management, cropping systems and rice-fish farming. IRRI networks, particularly INGER, have formed part of IRRI's contribution.

5.6.3 Assessment

Panel members were able to visit only one Country Project, Egypt, where IRRI has clearly made an appreciable impact on the development of the national research and training system; the inputs particularly valued by the Egyptian scientists are germplasm and training. The panel has gathered other information from documents, IRRI staff and, in the case of the Lao PDR project, the principal donor. The comments below primarily refer to Country Projects because as yet regional initiatives under this heading are limited and we consider that IRRI's plans for regional development in Africa should be discussed in the wider framework of the CG system as a whole.

The Country Projects appear to have a very positive influence on the development of national research and training systems. We regard the objective of national institution building as a legitimate and desirable activity for IRRI and would like to see greater acceptance of its importance throughout IRRI and its Board. However, we would not wish to see an significant increase in the number of Country Projects; the present scale seems to us about right. We also believe that Country Projects should be self-supporting and that they should not compete with IRRI's primary goal of conducting strategic research.

We believe Country and Regional Projects may often provide benefits to IRRI through access to germplasm or by providing greater experience of rice production systems throughout the world. We consider this latter benefit has attained greater significance since IRRI has widened the ecosystems in which it is working. An example came recently from the LAO Country Project where a diagnostic survey of slash and burn systems highlighted their importance and prompted the decision to include this type of system in the Upland Consortium.

We urge closer links with core research programmes and, with the exception of INGER, less emphasis on the traditional IRRI networks. We believe this would help to focus on research more relevant to national needs and would be more likely to provide feed-back into IRRI research. We would like to see explicit recognition of the time spent by core scientists on visits to Regional or Country Projects.

We believe that an important end objective should be to bring national systems to the point where they can then continue to work as partners with IRRI on a research collaboration basis. It should be recognised that this is seldom a short-term objective and Regional and Country Projects should ideally start with a long-term commitment.

We are pleased to note that IRRI is proposing to change the name of these Projects (perhaps to National Research Enhancement Projects) because the present name is often confused with technical assistance projects that are not related to research.

5.7 Overall Assessment

The Panel has found that the principal research-based services grouped in International Programmes are valuable and well-managed. In summary our assessment showed the following.

The Germplasm Centre and INGER are very highly valued by the national research systems, and are steadily being modified in appropriate ways to improve their services. The only concern we have expressed is that the quality of INGER's work depends crucially on having a senior scientist in charge who can devote sufficient time to the demanding international management role.

IRRI's Information Centre continues to rank high among similar programmes in other CGIAR Centres. The Panel noted the increased resources being devoted to public awareness activities. Recognising the strong pressures for such work, we wish to emphasize the equally strong need to maintain IRRI's high standards of scientific publishing. Furthermore, we have noted the great importance of refurbishing IRRI's Library, both in a physical sense and in the sense of bringing its services up to modern international standards. We believe this will continue to require an internationally recruited librarian.

IRRI's Training Centre is well along in a series of changes geared to reflect better the changing roles of IRRI as the NARS in many countries gain strength. In its training activities, as in its research, IRRI is moving upstream - toward more Ph.D. and less M.S. research training; toward devolving more training activities to the increasingly competent training programmes of the more advanced national research systems.

Country and regional projects are directly involved in helping to strengthen particular national rice research systems, the NARS, in specially-tailored fashion depending on the starting point in the particular country. We have been glad to see the

increased clarity of objectives, and of criteria for measuring success, that have come with the establishment of the International Programme Management Office.

By far the major area of concern for the Panel with respect to International Programmes relates to the three Networks: ARFSN, INSURF, and IPM-R. We believe the first two, while having a productive past, are not currently serving top priority objectives of IRRI. At the same time, the Networks are not IRRI's to dispose of, but require careful joint consideration by IRRI and the NARS before deciding what to do. If they were to be continued, IRRI should in our judgment greatly reduce the resources it is devoting to them. The third network, on integrated pest management, is fairly recent, and we suggest that IRRI consider, along with the relevant national scientists, whether to move its IRRI home to the relevant research division and to move its research agenda upstream toward quantitative pest ecology. We believe such changes might make for a more productive and appropriate use of IRRI's scarce scientific resources in the IPM field.

The Panel would like to emphasize the imperative need on a continuing basis to modify and improve the array of services and activities grouped under International Programmes. This continuing revision and renewal process should reflect two main dynamic factors: the steadily changing nature of the NARS, and the steadily changing nature of IRRI's research programmes.

The NARS are highly diverse, and they suffer from ups and downs of political support and funding. But on average and over time they are gaining competence and experience that will permit them to undertake more complex research tasks. As they do so their needs for training and other kinds of service from IRRI will change.

The second main source of dynamism is the changing nature of IRRI's research activities as they move upstream toward more strategic issues and toward bringing to bear more sophisticated methodologies. The research-based services of International Programmes must change accordingly - as they have done, for example, in offering new types of training programmes (e.g., biotechnology) or new types of nurseries in INGER (e.g., gall midge resistance).

For the most part we believe International Programmes have been adopting satisfactorily to the changing needs. But the future holds much challenge.

The Panel has been convinced by IRRI, and by its own assessments, that IRRI now faces a second generation of problems arising from increasing overall productivity and more intensive land use. These problems call for more integrated approaches in the identification of future constraints and in finding research-based solutions. This will also call for a higher level of interaction with and inputs from basic sciences, and use of modern research tools and techniques (including biotechnology, modelling, GIS, etc.) for solving important strategic and applied field problems. In the light of this we believe that IRRI must prepare itself to adequately respond to future demands from NARS that are likely to be varied in nature and more complex.

CHAPTER 6 - INITIATING AND RESPONDING TO CHANGE

The work of a scientific institute such as IRRI has its own dynamic. Its research generates a new set of problems, sometimes directly and sometimes as the results of the research being applied in the field. The institute then needs to examine that set of problems.

But IRRI has also to respond to external changes. Some emerge from the progress of science in general, which opens up new possibilities for IRRI's researchers. Some arise because of changes in the perception of its stakeholders. Issues which did not matter in the past become of pressing concern.

This chapter discusses several issues on which both external and internal changes have affected IRRI's programmes, and examines how IRRI has responded to them.

6.1 Sustainability

IRRI's stated goal is the improved well-being of present and future generations of farmers and consumers, particularly those with low incomes. The inclusion of future generations of farmers places long-term sustainability as a central concern. Asia, the region with which IRRI is most concerned, is experiencing continued population growth, which although decelerating, is still high by historical standards. Consequently IRRI has always striven for rapid growth of production, and it will still have to continue to do so. But its strategy now stresses that the production growth that is achieved must be sustainable in the long run.

Even though the term 'sustainability' has only recently come in vogue, IRRI has long had research relating to natural resource management pertaining in particular to irrigated rice and its production environment. For IRRI, the issue has always been the sustainability of the production systems in which rice is an important component. Some of the sustainability issues which the Institute has addressed previously included:

- long-term trials which began at the IRRI Farm not long after establishment of the Institute in 1961, and which now provide much valuable data on the issue;
- nutrient availability and efficiency in production systems (in part, through INSURF);

- production methods to reduce internal and external inputs, integrated nutrient management, land resource management, and development of methodologies for rice research in different production environments.
- studies of less-favoured rice production systems in the Asian Rice Farming Systems Network (ARFSN);
- breeding rice with greater pest and disease resistance and greater tolerance of abiotic stresses;
- understanding pest-damage threshold levels, designing IPM strategies, and measuring the impact of biocides on target and non-target organisms.

Today, IRRI has embarked on an even more ambitious effort to organize research around four production ecosystems. To the extent that sustainability questions can only be understood through a broader understanding of the interrelationships of the various elements of an ecosystem, then the new approach can address them more directly. Perhaps IRRI's most challenging task is to understand and begin to retard the prospect of declining yields in the most productive ricelands--a phenomenon that IRRI first drew attention to.

IRRI's capability to address sustainability issues is based on a long history of past research on some of the key questions. Currently, it has a large number of projects on this issue, which cover an extremely broad area, almost to the point where concern may be expressed whether breadth has not been purchased at the expense of depth. This concern can be raised, even if we are to exclude from consideration the large global climate change programme, which we shall discuss next.

6.2 Global Climate Change

The rising concern with global climate change problem is of particular concern to rice scientists, for the finger of blame is pointed to rice paddies as main emitters of greenhouse gases. IRRI took up the challenge in its strategic plan. Strikingly, warming trends are mentioned on page 1 of its plan, ahead of population trends which had normally been cited as the chief reason for doing rice research.

In recent years, IRRI has developed a large set of projects in global climate change, supported by the United States Environmental Protection Agency (EPA). Further support is expected from the United Nations Development Programme (UNDP) through the Global Environmental Facility (GEF). The EPA programme, a complex of research on several topics of interest to IRRI and EPA, is well underway. The UNDP-supported research is still being planned.

Levels of support for the projects are: EPA, US\$6.7 million for five years, and UNDP (expected), US\$8 million for five years⁹. The Panel was told that about US\$1 million of IRRI core funds are also allocated to this research effort.

The EPA/IRRI component consists of six basic studies relating to global climate change: (1) direct effects of ultraviolet-B (UVB) on rice, (2) direct effects of CO₂ and temperature on rice, (3) rice modelling, (4) effects of UVB, CO₂, and temperature on pests, (5) effects of UVB, CO₂ and temperature on diseases, and (6) methane emissions from irrigated rice fields. The EPA project is nearing the end of its second year of operation, the whole effort is administered within the Irrigated Rice Programme. Each of the six activity categories of the EPA project is handled by IRRI research divisions. An agronomist from the APPA Division is Project Coordinator. Some 6 or 7 IRS are involved in the project, with perhaps 1.5 to 2 full time equivalents.

The UNDP component is planned as a regional activity on methane emissions in Asia. It will entail 16 monitoring and research field units like the one currently being used at IRRI for methane emission studies, with one unit to be installed in each of four key sites in four countries; probably China, Indonesia, India and Thailand. The effort will probably require a research network and baseline-data-gathering network. A Project Coordinator has not been announced yet for this work.

There are two other small activities in global change at IRRI involving a Wageningen University graduate student who worked here on methane emissions and a Rockefeller Foundation Environmental Fellow who has just arrived and will work on nitrous oxide emissions as they relate to on-going methane emission studies. Other cooperation in the work included a team from the Universities of Georgia and Guelph who evaluated a new monitoring system for methane emissions.

These sets of activities in global climate change comprise a large effort, with perhaps nearly US\$15 million investment by special project donors over a five to seven year period. Much of the work is strategic in nature, relating either directly to effects of various factors on rice itself, to some of its diseases or pests, or to its major production environment, flooded rice. It will also quantify the relationship between observed meteorological variables and crop needs more precisely. IRRI is almost certain to gain new information about rice from these studies.

The Panel thus agrees with IRRI's decision to embark on this work. It would merely observe that although additional resources are being brought in to conduct this research, there are two hidden costs to these funds. The first is the diversion of some of IRRI's personnel to this task, personnel that could be used to conduct research of more immediate concern to rice farmers. The second arises from the fact donors do not fully cover the indirect costs of projects, and hence there is some subsidy by unrestricted funds to the special project.

⁹ Presentation of Research Programme to the Programme Committee, 21-22 September 1992. p.4.

6.3 Biotechnology

IRRI's biotechnological research is at present conducted in three areas: starting with tissue culture, proceeding on to gene tagging and finally to transformations.

Tissue Culture: In the early 1980's cell culture was used to obtain salinity tolerant rice. To accelerate quick acquisition of homozygous lines, anther culture is effectively used to breed for tolerance to salinity, cold weather and blast resistance. Embryo culture has been successfully used in wide crossings involving wild rice species, which became essential material to breed rice with highly durable resistance to diseases and insect pests, resulting in many hybrids acquired from crosses between 12 wild species and *O. sativa*.

Gene Tagging: Rapid progress in molecular biology has made it possible for breeders, geneticists or pathologists to enhance breeding efficiency, to locate the genes more easily, or to analyze and characterize pathotypes to seek more durable resistance. Some of the genes for resistance to bacterial blight, blast and white-backed planthopper have been tagged through linkage with RFLP markers. A gene for brown plant-hopper resistance introduced from *O. australiensis* has also been tagged with molecular markers.

Transformations: IRRI can now look forward to the challenging tasks of gene construction and transformation--the nearest practical targets being Bt toxin gene for controlling leaffolder and yellow stem borer; of using molecular markers routinely in the breeding program; and of locating quantitative trait loci linked with characteristics such as tolerance to abiotic stresses or resistance to pests and diseases. Reliable techniques for regeneration of plants from callus and protoplasts may be an essential tool for some methods of transformation. IRRI has so far succeeded in regenerating plants from protoplasts of IR24 and four other IR varieties and lines. Further concentrated efforts are required to establish the technology system for stable regeneration of indica rice plants.

Biotechnology is a powerful tool that is spreading through IRRI. Currently there are more than ten scientists applying this tool in their work, and the signs are that more will be doing so in the future.

It is impossible to talk of biotechnology in rice without mentioning the contribution of the Rockefeller Foundation. IRRI has been a large direct beneficiary from the Foundation's programme, but IRRI has also benefited indirectly. The Foundation has also funded the work of scientists in industrialised countries and stimulated a number of scientists to begin to pay attention to rice. IRRI as the premier rice research institute in the world is uniquely placed to benefit from this interest, and has been able to draw on their contributions through such innovative devices as shuttle research.

Many NARS scientists are also doing biotechnological work, some of it supported by the Rockefeller Foundation. The quality of some of their work is advancing rapidly. To some extent IRRI is acting as an effective intermediary between

the advanced institutes in the industrialised countries and the NARS. But IRRI's own work can also enhance these NARS' capabilities, because some procedures have become more economical, reliable and simplified, thanks to work done at IRRI.

This favourable interaction with the NARS will be enhanced by the proposed Asian Rice Biotechnology Network (ARBN), funding for which is now being sought. IRRI has, in addition, trained 120 scientists (degree, non-degree and group).

We are impressed by IRRI's capabilities in biotechnology, and we are excited by the prospect that its work in this area will enhance its capabilities in other traditional concerns, particularly the germplasm improvement work, that has been its mainstay, and commend its work in helping the NARS introduce these new technologies in their work.

6.4 Strengthening NARS

Institution strengthening is part of IRRI's Mission. This is a task that it has to perform while changes are occurring on two fronts: NARS are maturing institutions and science is progressing fast.

Because NARS grow at uneven rates, at any one time they appear quite diverse. IRRI has responded, first of all, by offering NARS a menu of options:

- it has had scientists resident in the country to work on applied research;
- it operates Country Projects, financed by special donor funds, to help create or develop research capacity;
- it offers many training courses, including a wide range of topics, such as Geographic Information Systems or biotechnology;
- its INGER network provides a most valuable service to the NARS.

These options are available for the NARS to choose, the presumption being that the NARS will choose what will benefit them in their work.

But IRRI has another motivation to interact with the NARS. IRRI scientists have often sought out NARS scientists, because their own scientific work will benefit from collaboration with NARS scientists. In recent years, the Institute has sought formal collaboration from NARS institutions in the form of consortia and networks.

Ultimately, regardless of which party initiates a relationship, it must be advantageous to both parties. Thus, the INGER network is not only of great benefit to the NARS participants, but to IRRI as well. Conversely, when a research consortium is set up, national scientists can get an opportunity to interact with and learn from IRRI scientists. Relationship between IRRI and NARS have remained warm because both

parties have gained. For IRRI, maintaining and strengthening its ties with NARS are therefore extremely important. IRRI has to invest time and resources in institution strengthening.

As the relationship between IRRI and a NARS becomes more complex, it also becomes more formalized, and the two sides may jointly determine an annual collaborative work plan, arrived at after looking at the entire selection of activities on which they may collaborate. IRRI has such joint plans with a number of the countries that have stronger NARS.

Such annual work plans are useful in putting order into the short-term management of the collaboration, and is a step forward. But institution strengthening is a long-term exercise and IRRI should support the NARS' evolution. IRRI would do well to take more of a developmental view with each NARS and work out its relationship with that in mind. One thing that might be useful is to take a look periodically (say, every five years) at what a country's strengths and weaknesses are in rice research, given the state of the science at that time. Improvement plans can then be drawn up based on such an exercise. The lead must of course come from the country concerned, but the help that IRRI and perhaps ISNAR could provide would be extremely useful.

IRRI also needs to think across-the-board about what it is contributing to institution strengthening, from Research as well as International Programmes. The role of Research Programmes is essential, for research collaboration is inherently a process in which standards of quality can be steadily raised and new techniques and methodologies learned. IRRI has a particular opportunity to work with NARS scientists right up to the very frontiers of science, as is currently the case in SARP and in rice biotechnology.

Institution strengthening has an indefinite timetable. It must be continually adapted to a country's level of institutional development and, for research institutions, to the growth of scientific knowledge.

6.5 Social Science and Policy Research¹⁰

IRRI has a distinguished record in its social science work. It faced far more challenging tasks than other IARCs and has lived up to it. When IRRI came out with IR8 and succeeding varieties, it wrought a major social transformation in Asia's countryside, and opened up a flood of criticisms that the transformation worsened the welfare of the poor in Asia. In responding to the critics, the economists at IRRI made major contributions, not only on the substantive issue, but to some degree also on the methodological problem of assessing the impact of technological change. This work has

¹⁰ This section does not include discussion of the Geographic Information Systems Laboratory, which has just been made part of the Social Sciences Division, starting July 1992 (Section 6.8).

continued and has been a long-term element of IRRI's social sciences work, culminating in the study on the differential impact of the new varieties among the ecosystems which came out only last year.

But follow-on work after the release of the new varieties does not end with an impact or a consequences study. The natural desire of the institute to see its biological work bear results in the farmers' field led IRRI's economists to involve themselves also in policy questions. It was clear from early on that the successful diffusion of new varieties depended on the availability of fertilizers and water. The insights into the conditions under which fertilizer subsidies would yield results came from them, and until the formation of IFPRI and IIMI, IRRI economists worked extensively on irrigation policy issues.

When new varieties were being diffused, IRRI's economists, in close collaboration with agronomists and statisticians, pioneered work on constraints to understand the reasons why farmers were unwilling to adopt the full package of the new technology. This exercise laid the foundations for quantitative work on research prioritization, which is now of great practical value.

IRRI's social scientists play an equally important role which outsiders get less of a glimpse of: they collaborate closely with biological scientists to examine various technological options. In few other IARCs is the working relationship between social and biological scientists as cordial.

If we are to fault IRRI on its social science work, it is the scattered nature of its work on equity problems. Its last major scientific output on this set of problems is the differential impact study. The new head of the Social Sciences Division has indicated his interest in working on disadvantaged groups. Included in this activity would be the current work on the role of women in rice farming which is fully discussed elsewhere (see Section 6.6).

To deal with the problems of disadvantaged groups engaged in rice production, it is necessary to concentrate on the role of labour. Despite the fact that rice is the most labour-intensive of the food crops, IRRI has done relatively little work in this area. Only two divisions in IRRI deal with it, Social Sciences and Agricultural Engineering. Without a clear understanding of the role of mechanical power (from men, women, animals and machines) in rice production, how the various sources of power substitute for one another at the technical level and at the social level, and who controls the introduction of new technology (and how), it would be difficult to link the work done on specific equity issues to the rest of IRRI's work. Without such a link, it is impossible even to attempt a prediction of the impact of new technology on the demand for various types of labour, the key determinant of the outcomes for the disadvantaged groups. An important by-product of this exercise could be a closer integration of the work of the Agricultural Engineering Division into the mainstream of IRRI's work.

Another important question often raised with respect to the IRRI's Social Science work is how much role it should have in policy analysis. IRRI is best served when the policy work requires close interaction with the biological-science community

in IRRI. Examples are the sustainability issue, which has many policy dimensions (e.g., pesticide policies, upland land-use policies) or intellectual property protection (see Section 6.7). Such issues are central to IRRI's scientific work, and clearly require it to engage in policy analysis.

At the more macro-level, questions can be and have legitimately been raised whether IRRI has the required comparative advantage, particularly in view of the presence within the CGIAR of IFPRI. It is fair to point out that where IRRI's policy work brings it somewhat beyond its technological specialization, it has always sought and, in most cases, obtained IFPRI's cooperation. Where IRRI's agenda differs from IFPRI's, however there may be good reason for IRRI to proceed. Such issues should be examined on a case-by-case basis and it would be unwise to make any blanket recommendation.

6.6 Gender Issues

IRRI has been a pioneer among the CGIAR centres in conducting research on gender issues. It embarked on the project *Women in Rice Farming Systems* (WIRFS) in 1987, as recommended by a Bellagio Conference on Women and Agricultural Technology and the Third External Programme Review. WIRFS is administratively part of the *Asian Rice Farming Systems Network*, and its research leaders, consisting of 0.4 IRS and one full-time NRS, were drawn from the Social Sciences Division until 1990. Since then only one full-time NRS from the Division has been assigned to this task. A visiting scientist has just joined the Division for half of her time.

The research objectives of the WIRFS project were to (a) document and list the set of activities and decision-making done by both men and women, (b) identify the constraints faced by women and (c) design develop and test technology suited to the needs of women. In doing these, it was expected that methodologies would be developed to identify viable technology suitable for rural women.

At the time it was set up, much of this work was new to international and national agricultural research institutes, and IRRI is to be credited with having opened up this area of research. In the five years since it was set up, WIRFS has lived up to its stated objectives, and a peer review conducted by IRRI has reported favourably on its performance. It has identified quite a few technologies beneficial to women, mostly produced by the Agricultural Engineering Division and mainly concerned with post-harvest activities. The research activities have also identified specific training needs for women. It has set up an active research network of some calibre in many of the participating countries, mostly drawn from universities, but including a few from the government research systems. It has created some awareness among IRRI researchers of the important role played by women in rice-farming, and gender analysis is being included in site characterisation work in many network and consortium sites.

Notwithstanding the pioneering role played by IRRI and these successes, a few hard questions have to be raised with respect to this effort. WIRFS has provided a great deal of information, but it has been information without much in the way of

theory. The peer review also criticized IRRI for being concerned only with women's issues, rather than with gender issues generally.

While it has succeeded in identifying various activities in the rural area to be in the women's or the men's 'domain', it has stopped short of asking why the sexual division of labour is as it is. Given the fluidity with which men's and women's domains may change, particularly when a new technology is introduced, it may be quite unwise, even dangerous, to recommend a change based on a static listing of current 'domains'.

IRRI therefore faces a difficult choice. If research on gender issues is to be more than mere tokenism, restricting resources to the present level of activity is not justified. If on the other hand more resources are to be committed to research (and we are pleased to see the appointment of the visiting scientist to work on this issue), then the questions to be addressed have to be different from the ones that have been thus far tackled, and requiring more sophisticated social science inputs.

We suggest that WIRFS should become more of the central research activities of the Social Sciences Division than it is at present. In particular, if it is the intent of the Division to work extensively on disadvantaged groups in rice-farming, then the role of women can be analysed most usefully in the context of an overall framework, at once rigorous and comprehensive, that looks into how work is assigned to different groups in a rice-farming community. Ideally, this task should be part of a major effort (see Section 6.5) that examines the role of mechanical power (supplied by both humans and machines) in agriculture. This would simultaneously help IRRI fulfil its stated goal of conducting research and developing technologies that will help the disadvantaged, among whom women are but one group. The WIRFS network would then be part of this research activity, which would also define its size and scope. In particular, the scope of the network's activities would be narrowed down to research, and its object of concern broadened to include disadvantaged groups other than women.

As designed, the WIRFS project was also to make gender issues an integral part of research activities in IRRI, so that they are entered into consideration from the start of the project. The peer review was satisfied that the WIRFS has succeeded to some extent in doing so. The Panel's view tended in the opposite direction. The inclusion of gender issues, as practised in IRRI at present, cannot lead to a prior assessment of the impact of technologies on men and women, because IRRI has not done much work on the use of labour in rice farming. Of the few cases where the WIRFS project has had an impact on IRRI's scientific work, the main one is the Engineering Division, which is directly concerned with machines/labour substitution.

We emphasize some of the problems with the WIRFS project in order to highlight the need for a clearer research focus, which we have discussed at length in Section 6.5. We do not wish to detract from many of the achievements of the WIRFS project, and are certainly not recommending any reduction in its volume of work.

6.7 Intellectual Property Protection

Intellectual property issues arise with IRRI's work in three areas: agricultural engineering, germplasm transfer and transfer of biotechnological know-how and materials.

Agricultural Engineering: The Agricultural Engineering Division has been a prolific designer of small agricultural machinery and implements. IRRI has taken out patents on its designs, and currently holds 39 such patents, the largest among CGIAR Centres. These patents are meant to be preemptive, to prevent the use of the designs for monopolistic gains.

IRRI has a policy of making its designs available to all who wish to produce them, without any licensing, and cooperates closely with firms (mostly very small) wishing to use its designs. As IRRI does not license the designs, it is not responsible for quality control, and the machines are not sold with IRRI imprint on them.

We are satisfied that the approach taken by IRRI on this issue is sensible, and commend particularly IRRI's services to the small machinery producers.

Germplasm: As the holder of the world's largest rice germplasm collection, IRRI's policy, reiterated many times, is to make germplasm and breeding lines available to all at no cost. This is in line with the CGIAR's Policy on Plant Genetic Resources issued in 1989, which states:

"It is the policy of the CGIAR that Centres should supply from active collections the germplasm requested by any *bona fide* research worker anywhere in the world...The CGIAR encourages all countries to support the unrestricted interchange of germplasm throughout the world".

Since February 1991, IRRI has required private companies to sign a Rice Germplasm Transfer Agreement, which requires them to attest to the following (and we quote the full text):

"We hereby agree that should our company's breeding activities using this germplasm result in the release of any licensed commercial variety, the company will give credit to IRRI as the source of seeds of the breeding lines and disclose the country of origin of the breeding materials used. The company will also commit itself to sharing any derived variety with IRRI and other organizations for rice breeding purposes without cost".

We are not in a position to judge whether or not such an agreement will hold up legally, but would merely observe that it does not preclude a private business from acquiring intellectual property protection on plant material derived in part from germplasm.

Materials and Know-how Used in Biotechnological Work: We are accustomed to thinking of IRRI as a producer of new technology. With increasing use of biotechnology in its research, IRRI has also become a recipient of technology - to be more precise, a buyer of technology.¹¹ Most transactions are one-time arm's-length transactions, and give rise to few problems, but there are some in which IRRI is implicitly taking positions on some of the thornier questions surrounding the intellectual property rights issue.

One instance illustrates very well the kind of dilemma that IRRI faces. In its work on the *Bacillus thuringiensis* (Bt), IRRI found that it would do better to obtain technical know-how from a Belgian company. In the resulting transaction, IRRI agreed to provide the company with Bt isolates from Asia. Further, IRRI will not release any strains or information emanating from the agreement to specific industrialised countries.

Pragmatically speaking, IRRI acted properly in entering into this particular transaction. If it had not, it might have denied real benefits to rice farmers in developing countries. But it merely reemphasizes the point we raise when discussing germplasm transfer, that the issue of intellectual property rights (in an imperfect world) is quite complicated, and requires a broad understanding.

We are in a rapidly moving world, both technologically and legally, over which IRRI will have little control or even power to influence. Both IRRI and the NARS in the region are having trouble keeping up with the pace of change. IRRI should become a leader, not in advocating a particular position on legal changes that may be taking place in the legislatures or the courtrooms of the world, but in exploring the implications of those changes to its own work, that of the NARS, and to the welfare of the farmer in the region. Because of its understanding of the new technology, IRRI is in a good position to assess these. Unfortunately, IRRI cannot afford the capability to track the rapid legal changes that are taking place in many countries. The Panel hopes that IBPGR, the logical place where the legal expertise would be, will acquire it.

6.8 Managing Research Data

Currently IRRI collects large volumes of primary data and makes extensive use of secondary information as well. IRRI has not been immune to the common complaint against many scientific institutions that it collects data well in excess of what it is capable of using, and much of it would lie unused in various forms in different locations. Without clear access and retrieval procedures, these data may as well not exist.

As IRRI's hardware is being developed and connected (see Section 8.7), researchers now have a chance to make more efficient use of the data that are now scattered in various parts of the institute. A task force was set up in 1991 "to develop a comprehensive program for a coordinated system to store, verify, monitor and update

¹¹ Its software purchase policy is discussed in Chapter 8.

information on all aspects of rice". Despite the ambitious nature of the task, it appears that IRRI is well on the way to achieving it. The system is based on relational database software. The data collection and updating will be decentralized at locations where people are in any case engaged in these tasks already. The main difference is that the fruits of their labour will now be readily accessible to other IRRI staff, subject of course to a researcher's right to priority of use.

A priority listing has also been made for conversion of the existing data into a common standard, with the rice statistics, the germplasm related databases and the GIS-related rice ecosystems placed at the top of the list.

IRRI is moving in the right direction, but we would put in a word of caution. If IRRI successfully implements its plans, IRRI may move from the current situation where data collection (and collation of secondary data) ran in excess of any likelihood of their retrieval and analysis, to a reverse situation where the database system will be constrained by the effort needed to collect and to update data for it to reach its full potential.

IRRI is now committed to using the Geographic Information Systems (GIS) as a major research tool. Its GIS Laboratory started operations last year, but it has been working on GIS-based system for some time in its characterisation work. That was scattered. IRRI is nevertheless among the first CGIAR Centres to get fully involved in this new area as GIS is particularly relevant to the ecosystem framework. IRRI's GIS work is currently proceeding at all levels from a macro (ecoregional) level all the way down to the village level. In terms of software and linkages, the CGIAR is particularly fortunate in receiving the donation of the main software for all the Centres from a major GIS-software producer (Arcinfo). GIS technology is now being developed at all CGIAR Centres, and discussions are under way to cooperate in the collection, processing and sharing of data.

In both the general database and the GIS, IRRI is finding new tools to make its scientific work more efficient. IRRI is in a position to assist national systems on the acquisition and use of these tools, so that they may develop information systems appropriate to their needs, and which will also allow them to have access to IRRI's own developing database. A by-product for the scientific community would be the emergence of a common standard for the various kinds of data that would be developed, which would simplify the task of analysis considerably.

6.9 Conclusions

This chapter has examined some of the areas where changes are taking place quite fast. IRRI has changed with the times. In many areas, it has been working on the substance of the problem well before the world finds a name for it: sustainability is one such area. In other areas, IRRI has responded with speed to suggestions from the outside that it reorients its thinking on some issues. Two examples would be the introduction of gender issues into IRRI, and its initiative on global climate change.

IRRI has been well served by its scientists. Where progress in the relevant disciplines or techniques (biotechnology and database management) requires them to reorient the way they go about their work, they have moved quickly. Its social scientists have worked closely with their colleagues in the biological sciences and in the Engineering Division, and have the process contributed to their own disciplines as well. They have also been active, at a more macro-level, in policy analysis which is necessary because rice is so important in Asia. They need however to resume a more active role on equity issues.

While IRRI is sensitive to the diversity of the NARS, and collaborates with them in different ways to fit the different stages of their development, IRRI could perhaps do more to assist long-term planning and growth processes of the NARS. Collaboration with ISNAR might be productive.

The area where IRRI has found it most difficult to stay abreast of developments is that of intellectual property protection. We understand IRRI's difficulties in coming to terms with this fast-changing problem, which in one area, namely the law, takes it beyond its normal fields of expertise. Nevertheless, this is an area in which it can provide information and insights to its colleagues in the NARS.

CHAPTER 7 - ORGANIZATION AND MANAGEMENT

7.1 Overview

As the first CGIAR centre IRRI's legal and governance structure has, in broad outline, been widely employed by sister institutions. While modifications have been and continue to be made, basically the model designed for IRRI has successfully stood the test of time.

As specified in its founding documents IRRI is a philanthropic, non-stock, non-profit Philippine Corporation. IRRI is accorded the status, privileges and perquisites of an international organization by decree of the President of the Philippines. While this arrangement is working satisfactorily, it is desirable to reconstitute IRRI through an international agreement. Discussions with respect to the matter are now under way with relevant authorities. The Panel endorses these initiatives.

Ultimate responsibility for IRRI's governance rests with IRRI's fifteen international trustees. These trustees select the DG and elect fellow Board members. While the focus of their deliberations is on policy formulation, they are challenged to be sufficiently well informed and capable to monitor operations and offer wise counsel with regard to IRRI's strategies, plans, programmes, and management. At the same time they must restrain themselves not to become directly involved in the day-to-day management of IRRI's business. Management, of matters other than the business of the Board, is properly the province of the DG and his staff. It is with the foregoing in mind that we comment next on the functioning of IRRI's Board of Trustees during the period under review.

7.2 Governance and Leadership

7.2.1 Functioning of the Board

During the last few years, IRRI's Board has made substantive, positive changes in virtually all areas affecting its performance. Today, the Board has good leadership and its committees are active and functioning well. The distinction between the Board's role (policy making) and that of the senior executives (management) is understood. The excellent documentation provided to them is exemplary in content, organization, and timely delivery. This improvement has come about as the result of an IRRI decision to commit the resources required to support the trustees' work professionally. The Board operates in an open but businesslike, straightforward manner with good member participation. A serious evaluation of DG performance is conducted annually and the Board has made a self-evaluation of its own activities. Relationships

between the DG and the Trustees are good and proper; those between the Chair and the DG are cordial, supportive and candid. Committees, which do much of the Board's work, take their tasks seriously. A second woman trustee is scheduled to join the Board in January 1993.

A particularly impressive Board practice is the manner in which the Programme Committee handles its business. Because it reviews and discusses programme matters systematically two times a year, the members are able to stay current with what is going on. Well written minutes of all committee and Board meetings are promptly prepared and widely distributed as is a careful log of specific actions taken. Understandably, both the trustees and staff members would like to have more opportunities to interact with one another on a one-to-one basis. But the Chair makes up for this in part by communicating the results of the trustees' deliberations directly to an Institute-wide staff meeting at the end of each Board meeting.

The 1987 External Management Review recommended that several major improvements be made in the way the IRRI Board carried out its responsibilities. Virtually all of those recommended changes have been successfully made (Appendix VII). This does not mean that additional changes are not needed. To our view, management succession in the Board needs to be better secured by further improving the trustee nomination and selection process. For example, we note that the Board Chair and the Chairs of two key committees all complete their terms next year (Table 7.1). It would be comforting indeed if the Board had more members who were able, experienced, ready and willing to step into these vacancies. This suggests that in its search for new trustees the Board would be wise to place highest priority on the selection of individuals with the types of capabilities most needed - even if it requires deviation from what is viewed as optimal geographic distribution.

From our interviews with new trustees and from the responses of trustees to a questionnaire survey conducted for this review by the CGIAR Secretariat, it became apparent that their initial orientation to their responsibilities and to IRRI left much to be desired. An informative, well organized, up to date *Board of Trustees Handbook* has now been prepared. That should be quite helpful. Nevertheless, the Board should charge an appropriate person with the responsibility of carrying out a thorough orientation of new trustees. When one takes into account the fact that three trustees are *ex-officio*, the effective number of working Board members is small. Given the work load that the Board has set for itself and the need not to have the same trustee serve on more than two committees, we are sympathetic with the Board's desire to increase its membership by one.

7.2.2 Leadership by Senior Management

Capacity to visualize and generate change is an accepted hallmark of good leadership. The ability to achieve goals is an important attribute of good management. Thus, strong leadership and good management are essential for setting strategic directions and implementing plans, with minimal disruption.

Table 7.1 IRRI Board of Trustees and their Terms of Office, 1985-1993

NAME	NATIONALITY	85	86	87	88	89	90	91	92	93
N.R. Collins	USA	x	x	x						
E.J. Angara	Philippines	o	o	o						
<u>M.S. Swaminathan</u>	India	o	o	o						
J.J. Hardon	Netherlands	x	x	x						
R.K. Cunningham	United Kingdom	x	x	x						
K. Hemmi	Japan	*	*	*	*					
X. Guan-Ren	PROC	x								
T.A. Abdullah	Bangladesh	x	x	x	x					
Y. Sarikaphuti	Thailand	x	x	x	x					
L.T. Evans	Australia	x	x	x	x	x				
A. Blumenschein	Brazil	x	x	x	x	x				
M.V. Rao	India	x	x	x	x	x				
I.N. Oka	Indonesia	x	x	x	x	x				
L.E. Obeng	Ghana	x	x	x	x	x	x			
S.H. Escudero III	Philippines	o								
R.V. Mitra	Philippines		o	o						
Z. Yihua	PROC		x	x	x	x				
C.G. Dominguez	Philippines			x	o	o				
H.A. Stepler	Canada				x	x	x	x	x	x
D.F.R. Bommer	Germany				x	x	x	x	x	x
<u>K.J. Lampe</u>	Germany				o	o	o	o	o	o
J.V. Abueva	Philippines				o	o	o	o	o	o
W.P. Falcon	USA				x	*	*	*	*	*
M. Yunus	Bangladesh					x	x	x	x	x
K. Kyuma	Japan					x	x	x	x	
P. Wannapee	Thailand					x	x	x	x	x
J.R. McWilliam	Australia						x	x	x	x ^{2/}
R.S. Paroda	India						x	x	x	x ^{2/}
I. Manwan	Indonesia						x	x	x	x ^{2/}
S.C. Bacani	Philippines						o	o	o	
V.T. Xuan	Vietnam						x	x	x	x ^{2/}
S. Tsuru	Japan								x	x
P.W. Kariuki	Kenya								x	x
R.S. Sebastian	Philippines								o ^{1/}	o
Total number of Board Members		15	15	15	15	15	14	13	15	14

* Chairman of the Board of Trustees

o Director General/Ex-Officio Board Member (underlined names indicate Director General)

^{1/} Replaced Sec. S.C. Bacani beginning 1 July 1992. Terms of office of others begin 1 January and end 31 December^{2/} Re-election for the second term to be confirmed by Board in September 1992

In Chapter 2 of our report we highlighted the main dimensions of the transformation IRRI has been undergoing since the last external review. The changes made have been radical and affected the very foundations of IRRI as an institution. They concerned the identity of IRRI as an institution and as a community, why it existed, what it stood for, and what it sought to achieve.

The lion's share of the credit for IRRI's transformation goes to the visionary and energetic leadership provided by the Director General each step of the way. He initiated and led a time-consuming but consensus-building strategic planning effort that brought clarity to IRRI's identity and purpose. He followed this with a major and carefully-designed effort to realign IRRI's staffing, from the top management positions to the lowest levels of the IRRI hierarchy, including an unprecedented and bold downsizing effort which slimmed IRRI's NRS by 25 percent, and another that led to replacement of half of IRRI's internationally recruited staff. He led a successful campaign to raise the nearly US\$12 million required to rehabilitate IRRI's outmoded facilities, and another to introduce a matrix system for managing research.

During IRRI's transformation the DG had the backing of his Board, the management team he assembled, and the many friends of IRRI who were convinced that the institution needed to be revitalized.

As expected, it was not an easy transition. The external reviews five years ago found that IRRI suffered from institutional 'hardening of the arteries'. Opposition to changes from inside and outside of IRRI required lengthy deliberations which at times left scars, some of which are still visible. The levels of stress were high, not only among staff, but also among their families. Scientists had to devote time to the processes necessary for change, taking energy away from research. Departures of colleagues raised fears among staff about their own futures. As a result, morale was down and there was an unsettled feeling among staff. Many were uncomfortable about new and different ways of doing things.

IRRI is not yet at a steady state. Most of the planned changes have been made and productivity and morale appear to be on the rise. However, the changes that really count - the changes in attitudes and convictions of people - are not complete. Also, many staff are tired of change. Some still feel insecure, not knowing what may come next from top management. Both IRS and NRS seek reassurance of their worth and greater clarity about their futures. Researchers desire stronger scientific leadership and attention to scientific quality.

In summary, IRRI's top leadership has successfully brought the institution to a new threshold of productivity and opportunity. Now the leadership challenge is to steady the course by generating renewed confidence within the IRRI family and bringing greater stability to the working environment. For this, top management and staff need better understanding and appreciation of each other's concerns. Both have proven in the past that they are equal to this task.

7.2.3 Assessment and Recommendation

In CGIAR circles there is concern about the capacity of centre boards to carry out their pivotal responsibilities effectively and consistently. That is one of the reasons that we have gone to such length to spell out the improvements made by the Board whose work we are reviewing. We conclude that the IRRI Board is functioning well.

Recommendation 7.1

The Panel recommends that the Board further improve the way it selects and orients its new trustees.

With respect to our assessment of senior leadership, we observe that through its strategic planning process the Board and management decided that major changes were in order. Many of the changes mandated, such as altering the mix of scientific talent and downsizing staff, were both unsettling and demanding. It is our sense that leadership has demonstrated that it was equal to the demands of the change-driven tasks. The present challenges are primarily those of consolidation and moving forward on an even keel.

7.3 Organizational Structure

IRRI's strategic plan is the driving force giving rise to the present organizational structure. Figure 2.2 shows the way the Institute divides its activities into organizational units, how authority is delegated (down the hierarchy) and what the intended vertical reporting relationships are.

IRRI's current top leadership structure was designed and staffed to cope with the special demands imposed by the transformation which is now well along. As this process nears completion and the extraordinary management requirements of special initiatives (such as instituting the new program management and matrix organization system, realigning both the IRS and the NRS, and rehabilitating IRRI's infrastructure) structural changes in organization may be desirable. This will depend upon such considerations as the strengths and styles of the DG and his top management team, as well as the nature and size of the Centre's business. It is conceivable, for example, that the Director for Administration might handle both his present portfolio and that of the Director of Operations. At present, however, the changes in organizational structure that most interest us pertain to research management (Chapter 4).

A structural matter that is not discussed in Chapter 4 is the functioning of three high level standing committees. All three of these committees are important communication mechanisms, operate on a collegial basis, and help facilitate consensus building. The Steering Committee (SC) consisting of the DG and three DDGs is at the top of the pyramid. Among other matters the SC receives and reviews recommendations of the other two high level committees - the Institute Programme Committee (IPC) and the Management Committee (MC). It meets at least twice a month. Its stated function

is to review the recommendations of all other committees (or decisions which may have been delegated to them) as an executive level forum and make recommendations to the DG. In practice, because the DG is the chair, the SC does take decisions and a listing of these actions is distributed to staff within three days.

The IPC is a large institute-wide body, co-chaired by the DDGs for research and international programmes, and composed of the DDG - Finance and Administration, Director of Finance, Director of Operations, all division and centre heads, and programme leaders. The IPC is in effect a forum for reaching consensus on institute guidelines, procedures, position papers, programme, and policy changes for recommendation to the SC.

The MC performs the same function with respect to management - related issues that the IPC deals with in the programme area. It has eight members - the four on the SC plus the directors of finance, administration, and operations and the manager of human resources development. It is currently chaired by the DDG - Finance and Administration.

Minutes, of both the IPC and the MC, are widely distributed within a week of the committees' meetings. Both committees meet monthly. The DG participates in IPC and MC meetings as the need arises.

These committees are a major means of communicating and sharing information horizontally across the research and international programmes, finance and administration. Such functions must be performed. While the committees consume time, they are an integral part of IRRI's organizational structure. Hence, the management task is to make them function as efficiently as possible.

IRRI's dispersed operations pose horizontal communication problems for out-posted staff. That aspect of IRRI's structure was materially improved with the establishment of an International Programmes Management Office. Responsibility for arranging needed backstopping and seeing to it that liaison functions are performed promptly is now pinpointed in the Head of that office who oversees country and regional projects. This new arrangement seems to be working satisfactorily and is expected to improve further now that each outposted staff member is likely to be linked to the appropriate division and thus will have a disciplinary home.

7.4 Planning and Review Processes

During the last five years IRRI has been deluged with an almost continuous succession of planning and review exercises. Because many of these exercises are externally induced, (by TAC, the CGIAR, donors, Non Governmental Organizations (NGOs), etc.) their timing and content are not necessarily under IRRI's control. This is an important matter. In some cases these exercises have even overlapped one another. For example, while the main phase of this review was underway staff were busily engaged in preparing IRRI's mid term plan for 1994-98 and hosting reviewers from two NGOs.

As already noted, planning and review activities are fully participatory. Thus, the time consumed is for some staff a substantial portion of that available. No one wishes to engage in planning or reviews that are ends in themselves rather than means to a greater end. Such endeavours can and often do compete with rather than complement the research and educational work for which the Centre exists. Therefore, IRRI and relevant external entities need to make careful *ex ante* benefit-cost analyses before deciding to initiate such activities.

7.4.1 Strategic and Operational Planning

IRRI's first major long-term institute-wide strategic planning exercise was launched in 1986. The third draft of that "unofficial" plan was presented to the external review teams in 1987. The review teams, while commending IRRI for initiating such an important effort, felt that the draft plan lacked a vision of the future foreseen for the institute; was vague in its statement of priorities, goals and objectives; and looked primarily at IRRI's programme rather than at the totality of the institution. With the arrival of the new DG in 1988 work on the strategic plan was refocused and expedited. The resulting long-term strategic plan, *IRRI toward 2000 and Beyond*, was completed in 1989 as was the Centre's first five-year operating plan which covered the period 1990-1994.

Our sense, as reflected in our commentary throughout this report, is that IRRI's vision of the future program of activities and priorities as laid out in the long-term strategic plan is valid and appropriate and is providing guidance for the Institute's overall organization, programmes and operations. Goals and objectives are presented for each of the five ecosystem research programmes and for the activities pursued under what the plan calls international support programmes. These and the means employed in pursuing them are spelled out in greater depth in the five-year operating plan. Priorities are clarified by specifying the financial and human resources allocated to programmes and sub-programmes (which in annual budgets are further broken down by individual projects). The transparency of this planning process is appreciated by staff, clients and donors alike.

Strategic and five-year operating plans are seen as iterative. Revisions in operating plans with some shifts in priorities occur frequently - in response to externally as well as internally induced forces (lessons acquired from experience, changes in fund availability, changing CGIAR policies, etc.). In the process of deciding how and when plans are to be changed IRRI draws on the counsel of colleagues in developing countries, external reviewers of several types, donors, and, of course, TAC. This leads us logically into consideration of the monitoring and review mechanisms IRRI employs.

7.4.2 Internal Monitoring and Review

Mechanisms employed by IRRI for monitoring and review are of four general types all of which are intended to help the institution maintain scientific quality and relevance: 1) those built into the institute's programme-budgeting research-management model; 2) those done through direct staff-trustee dialogue; 3) peer reviews; and 4) impact assessments.

In the first type, staff members involved assess actual performance (output) relative to the project's or programme's stated goals. Results of this assessment are taken into account in adjusting work plans. This type of assessment is designed to produce a much more substantive product than the series of presentations by individual staff members of a 'show and tell' nature that characterized IRRI's former internal programme review. While the old model was a useful communication device and quite helpful in orienting new staff members and trustees, it was seldom sufficiently analytical to provide a critical input into the scientists' work. Nor did the earlier process crystallize policy issues for consideration by the Board and management.

The second type of review involves the presentation to the Programme Committee of the Board of written and narrative reports of progress and issues of the research and international programmes. Scientists and trustees engage in open dialogue in the discussions that ensue. Later in the week the Trustees' Programme Committee makes its oral and written report to the full Board and the Board Chair reports to IRRI staff at the end of the meeting. Because both the staff and trustees do this work well, this review has proven to be useful. It is a means of bringing to bear the informed views of concerned individuals who are one step removed from the actual projects. Nevertheless, this useful mechanism has drawbacks. The trustee committee simply cannot allocate enough time to this exercise to cover all programmes in detail every year and do the job well, so care has to be exercised in selecting which ones should be examined and in what depth. Further, with a recent change, this process now gives increasing attention to the role and functioning of IRRI's research divisions. Prior to 1987, IRRI trustees tended to neglect management issues. That was corrected. Now the trustees are making an organized effort to be better informed about what is happening in the divisions. We regard this as a positive development.

The third mechanism, peer reviews, was recommended in the 1987 external review. Since then 11 peer reviews have been conducted: five on programmes, projects or activities in research; one at the disciplinary level (Entomology); four involving international programmes; and one (Women in Rice Farming Systems) which was classified as both research and international programmes. One was carried out in 1989, five in 1990, four in 1991, and one in 1992.

Presumably these reviews have been helpful because IRRI has implemented a high proportion of the recommendations they contained. We note, however, that all 11 of the reviews have been almost exclusively oriented towards programme content and did not sufficiently cover quality of scientific inputs, processes and outputs. The terms of reference were generally too broad to expect the reviewers to make critical inputs into the improvement of science at the disciplinary level.

The fourth mechanism, impact assessment, is a somewhat different kind of review. Such assessments may be and often are research projects in themselves. Most are *ex post* in nature. They seek to determine the consequences of actions already taken or expenditures already made - rates of return on investments in research or training, the socio-economic or environmental consequences of adopting a new technology, etc. But increasingly there is need for prior (*ex ante*) assessment of the probable socio-economic and/or environmental impact of a technology, programme or policy. Such assessments

are often difficult to make. Interpretation of findings may turn out to be controversial. Methodological problems exist. For example, fully satisfactory techniques for measuring (*ex ante* or even *ex post*) the impacts of technology on intergenerational equity have not yet been developed.

Because of such problems, and the claim by some that IRRI's assessment of work in which it was involved might not be fully objective, it has been suggested that the Centre should leave impact studies to others. We disagree. Outside assessments should of course be made. But IRRI needs to do so also - especially it should conduct *ex ante* impact studies as an aid to setting programme priorities. IRRI is doing just that. Currently it is engaged in nine studies designed to measure socio-economic, environmental, developmental impacts. One of them involves the use of *ex ante* impact assessment in establishing priorities for rice research.

7.4.3 Assessment

IRRI has made real progress in its long- and short-term planning. Strategic and operating plans are in place and are guiding the institution's structural and programmatic development. Further, extensive improvements have been made in monitoring and review processes. It is our view, however, that overplanning and overreviewing can stifle progress, especially in a research organization. Now that IRRI has substantial experience in strategic planning it is in a position to modify its strategies quickly in response to major challenges such as those that are occurring in funding. Even so, such modification exercises should be kept to the minimum necessary to reflect changes in direction.

With respect to monitoring and review processes we would like to make the following two recommendations:

Recommendation 7.2

The Panel recommends that future peer reviews include a critical assessment of scientific quality.

Recommendation 7.3

The Panel recommends that IRRI continue to conduct impact assessment studies.

7.5 Institutional Relationships

In policy and in practice IRRI is an open, externally oriented institution. Its products and services are widely sought and appreciated. Thus it is not surprising that we find the Institute's institutional relations both cordial and satisfactory.

In this section we discuss linkages and relationships with five sets of institutions: host countries; national institutions; international organizations; advanced

scientific institutions; and donors. Because space does not permit us to dwell on many of the positive aspects of these generally high quality relationships, our focus is on recent developments and evolving issues.

A sense of the magnitude and far reaching range of IRRI's international relationships may be gleaned from the following. As of August 1992 the Institute had agreements for cooperative activities with: 1) 42 different organizations (mostly research institutions and universities) involved in the national research systems in 14 developing countries; 2) 31 research institutions and universities in 9 industrialized countries; 3) 15 IARCs, three of them not affiliated with the CGIAR; and 4) with two other regional/international centres.

Additionally, IRRI's research Programme had a total of 29 contracted projects and collaborative agreements in nine industrialized and five developing countries, while its International Programme listed 13 country and regional projects plus three networks in this category.

7.5.1 Host Country Relationships

IRRI interacts with its host country the Philippines at numerous levels and in a variety of ways. Most immediate are the daily interactions with the University of the Philippines at Los Baños (UPLB), IRRI's landlord, and the community of Los Baños. These complex cross-cultural relationships require constant sensitive nurturing by all parties involved. Factors contributing to the fact that these relationships appear to be strengthening include:

1. prompt efforts to identify and deal with emerging issues through regular meetings of the UPLB - IRRI Committees on Administrative Affairs and Research and Training, which report annually to the UPLB - IRRI Cooperative Council chaired by UPLB Chancellor Aspiras and IRRI DG Lampe, and on a personal level between the two heads;
2. UPLB - IRRI yearly work plan meetings. For 1992 14 collaborative research and training projects were agreed upon;
3. recognition and appreciation of the critical role that UPLB's graduate school performs in educating the M.S. and Ph.D. students, 30 and 40, respectively, in 1992 working toward their advanced degrees with IRRI scientists;
4. joint UPLB - IRRI actions to help improve needed services and infrastructure in the municipality (e.g. garbage disposal, highway maintenance, security, etc.);
5. agreement, after extended deliberations between IRRI, UPLB, and the larger Philippine community, with respect to next steps in the development and operation of needed containment facilities.

Beyond the campus and at the level of governmental and other public institutions, perhaps most significant is the development of PhilRice - the country's own national rice research institute with adequate land, good facilities, a dedicated staff, and its own identity. Before PhilRice it was government policy for the country to rely primarily on IRRI for rice research. With PhilRice firmly established as an independent but highly collegial peer of IRRI's, the nation has its own competence and voice on matters pertaining to rice. It can address rice-related issues of concern to Philippine producers, consumers, environmentalists, government policy makers and the public at large. A degree of widely felt tension generated by excessive dependency on IRRI has been removed. In its stead IRRI has another valued institutional colleague.

Annual PhilRice-IRRI collaborative work plan meetings are held. For 1992, 33 activities were discussed. IRRI also has collaborative activities with the Philippine Department of Agriculture in areas of quarantine, IPM, farming systems, agricultural mechanization, publication and communications and rice seed production. During the last two years, collaboration with the Department of Science and Technology in the area of biotechnology and biosafety has been strengthened.

The Philippines is not IRRI's only host country. As the institute decentralizes its work, its list of host countries lengthens and the complexities of off-campus operations increase. These place rising demands on IRRI to make certain that relevant memoranda of agreement are carefully worked out and fully understood in advance of initiating new or changing old working arrangements. Proper 'diplomatic preventive maintenance' in structuring formal relationships can lessen the likelihood of disruptions caused by unrealized expectations by either party. In our country visits we observed that, while methodological, personal recognition, and other 'partnership' issues existed at the operating level, overall IRRI - host country agreements were working satisfactorily.

7.5.2 National Institutions

NARS. Directly or indirectly (via the Inter-Centre Rice Review Team) we have held discussions with management and staff members of NARS in nearly all of the major rice producing countries of the world. Additionally, on behalf of the Review Panel, the TAC Secretariat has surveyed NARS worldwide (65 responses) to obtain their assessment of IRRI's past programme performance and needs (see Appendix IV for the results). Our major conclusions from the visits and the survey is that IRRI's work in germplasm conservation, evaluation and dissemination is seen as invaluable. INGER (see Section 5.2) is held in especially high esteem. It is the great value they find in this work that endears IRRI to them. This, along with the IRRI training so many have received (IRRI now has over 7100 alumni) undergird personal and professional relationships that are strong and enduring.

The existence of such generally good two-way relationships does not prevent problems from arising. An issue of intellectual property rights involving hybrid rice with China is a case in point. Happily, that problem now seems well on the road to solution.

A fairly frequently mentioned concern involves the nature of working partnerships. Such concerns are illustrated by these words of a prominent NARS leader, "Partnerships involve designing and executing collaborative research from the bottom up. No longer are we or should we be merely data collectors for IRRI scientists. Nor do we appreciate IRRI taking unilateral decisions that should involve both of us". What comes through clearly to the Panel is that even with IRRI's recent initiatives in joint planning and research consortia, it is virtually impossible for the Institute to be too careful about the fairness of its dealings and the provision of full and appropriate recognition of personal contributions made by everyone.

NGOs. Relatively new to IRRI is its growing relationships with another group of national organizations, NGOs. On IRRI's initiative we held meetings with representatives of four Philippine NGOs (The Congress for People's Agrarian Reform; The Sustainable Agriculture Coalition; the Agency for Community Education Services; and IRRI Watch). Also some of us also attended parts of a two-day NGO-IRRI dialogue at the Centre. These IRRI - NGO discussions were intended to serve at least two purposes: 1) to achieve better mutual understanding of viewpoints held and of the actual socio-economic and ecological impacts of the work of IRRI and similar production-oriented research organizations; and 2) to consider the development of working partnerships (in the Philippines and elsewhere) in the conduct of mutually agreed upon rice-related activities. It is too early to assess the rate at which progress may be achieved on these two fronts. But we applaud IRRI for the open stance taken and commendable initiatives now under way with the NGO community. Relationships between some of the NGOs and IRRI could easily have become highly confrontational. Instead, because open dialogue has been facilitated, there is far greater mutual understanding.

Private Sector. Another of IRRI's unique features is its linkages with private manufacturers of small farm machinery and equipment. The institute holds over 39 patents (12 pending) on items its Agricultural Engineering Division has designed. These patents are handled as if they were in the public domain. Blueprints are distributed free of charge. The function of the patents is to prevent the exploitation of intellectual capital IRRI has created. We visited some of the manufacturers and distributors of IRRI-designed equipment. Our impression is that this IRRI-private firm relationship is an advantageous one to the parties directly involved and, more importantly, to the rice producing community at large.

7.5.3 International Organizations

In this section we comment briefly on IRRI's collaboration with sister CGIAR Centres, with other IARCs, and with non-donor development organizations such as FAO.

Collaboration involving varying degrees of commitment presently exists with 12 IARCs of the CG system. Of long-term duration are the arrangements with IITA, CIAT and WARDA involving rice production research and INGER - related matters; with ICRISAT in rice related farming systems research particularly in India; with IFPRI in collaborative policy - related research; and with IIMI on irrigation

management work. More recently collaborative research on rice - fish farming systems has been undertaken with ICLARM and a substantial wheat - rice project is now under way with CIMMYT. Some work has been undertaken with IBPGR, and IRRI has helped provide back up for CIP's office in the Philippines while ICARDA has done the same for IRRI's work in Egypt. Additionally, IRRI is currently collaborating with ICRAF in the development of a new, ecology-oriented project focusing on slash and burn agricultural systems.

With respect to non-CG affiliated IARCs, IRRI worked with ICIPE for a number of years in a collaborative arrangement that has now been terminated. It has an arrangement for the exchange of scientists with IFDC to do integrated nutrient management work and, without a formal agreement, soils work with IBSRAM and rice - vegetable farming systems work with AVRDC.

Working arrangements with three other non-donor, non-affiliated institutions merit mention. One is IRRI's successful collaboration with FAO in field-level applications of integrated pest management techniques which the Centre has helped develop and the second is CAB International. The third is a prospective research project with the World Health Organization's panel of experts on environmental management involving environmental control of human disease vectors.

7.5.4 Advanced Scientific Institutions

IRRI's 29 contracted projects and collaborative agreements, some of which have substantial numbers of sub-projects, are primarily with advanced scientific institutions (ASIs). Some of the arrangements are with institutions such as Centre de Cooperation Internationale en Recherche Agronomique pour le Développement (CIRAD) and Institut Français de Recherche Scientifique pour le Développement en Cooperation (ORSTOM) which second scientists to IRRI thus providing both support and built in linkages. That the number and significance of arrangements with ASIs is rising is not surprising given IRRI's increasing emphasis on strategic research. As might be expected, however, with one exception the contracts and arrangements are with public bodies and not with for-profit private sector firms. This prompts us to ponder whether, as more of the world's strategic research in areas using biotechnology is done in the private sector, IRRI should or could establish working linkages there. Informal ones exist (e.g. occasionally a research task or needed technical training may be purchased from a specialized firm). Further, we recognize the advantages associated with IRRI's developing its own scientifically advanced, often highly specialized laboratories and research skills. But the institute must continuously ask: How much is enough? What degree of reliance should IRRI place on ASIs be they public or private?

In an experiment which may yield a partial answer to such questions, IRRI has made arrangements for one of its biotechnologists who is 100 percent on the Institute's payroll to shuttle between Los Baños and Cornell University. She spends 10 months of the year in laboratories at Cornell and two at IRRI. We view this experiment as a creative arrangement. We cite it because we believe that other innovative shuttle-type arrangements, possibly including some with private sector institutions, merit further consideration. We recognize that an array of obstacles has to be overcome in

working out each such arrangement. But it is our sense that the pay-off of such unconventional employment arrangements will rise as IRRI's involvement in strategic research intensifies.

7.5.5 Donors

While institutional memories in the CGIAR are fading, many donors still recall that IRRI's remarkable achievements in the 1960's helped catalyze the formation of the system. As a flagship institution in the system IRRI is respected and supported by a broad base of donors. Last year 26 of them contributed to the Centre's budget. In our visits with several donors we found them much interested in the external review, especially with the impact of the transformation they knew to be under way at IRRI. Among the varied matters they voiced was their concern that a global strategy for rice research be worked out soon so that the various responsibilities of IRRI, CIAT, WARDA and IITA can be rationalized.

IRRI has an active programme through which it interacts with the diplomatic community in Manila. Ambassadors of rice growing and donor countries (and of prospective CGIAR member nations) are invited to IRRI regularly. Special programmes are arranged for them so that they come to know what IRRI is and what it does. This is but another dimension of the Institution's open, cordial relationships with its extensive and committed group of donors. Activities along this line have resulted in the Republic of Korea joining the CGIAR in 1991.

Based upon the evidence we have collected, we judge donor-IRRI relationships to be first class. How else could a centre raise almost US\$12 million in special project funds for infrastructures rehabilitation?

7.5.6 Assessment

IRRI's excellent external relationships are a great source of intellectual, financial, and institutional support. Each year the Institute increases its numbers of cordial, productive relationships with an ever larger number of institutions in both developing and industrial countries. These relationships are dynamic. They are regularly reviewed and revised as befits the changing circumstances of the principals. Increasingly they are, in fact, working partnerships.

IRRI has recently established an open on-going dialogue with NGOs, a development we applaud. It also continues to deepen its relationships with increasing number of advanced scientific institutions world wide. As has been the case from the onset, IRRI enjoys the earned respect and support of a broad base of committed donors now numbering 26.

In sum, the Institute's relationships with external institutions may be thought of thus: IRRI needs them, they need IRRI, and the world of rice producers and consumers needs them both.

7.6 Overall Assessment

The prime mover in the successful transformation made in IRRI's organization and management over the last four years is its Director General. During this same period its Board of Trustees, under the able leadership of its Chair, has vastly improved the effectiveness with which it performs its governance and leadership functions.

Through the teamwork of the DG, the Board, and the staff, IRRI has successfully developed and implemented its new method of managing its research. Because this is the most far-reaching development in IRRI's organizational structure, an entire chapter (Chapter 4) is devoted to this topic.

IRRI's planning and review processes, some of them newly adopted (e.g. peer reviews) are thorough and ongoing. We see in the peer reviews a help in strengthening disciplinary scientific excellence. With respect to planning and review exercises in general, however, we urge IRRI and the commissioners of the reviews to guard against excesses. Because many of them are externally induced, the numbers, timing, and content of these exercises are not under IRRI's control. We regard it as essential that every reasonable effort be made by both external entities and by IRRI to lighten the load on staff in this area.

Because IRRI is such an open, externally oriented Centre, its institutional relations are cordial, extensive and productive. We enthusiastically support the joint move by NARS and IRRI to make these relationships genuine partnerships. We congratulate IRRI for opening what promises to be an ongoing dialogue with NGOs and we regard the deepening relationships with advanced scientific institutions worldwide as critical to the forward march of science at IRRI.

In sum, we are impressed with IRRI's achievements over the last five years in improving the Institute's organization and management. This new foundation is likely to serve IRRI well in the years ahead.

CHAPTER 8 - ADMINISTRATION AND OPERATIONS

8.1 Overview

The structure for administration and operations has changed significantly in the top positions since the last Review, but not markedly immediately below those levels. Previously, Budget and Accounts, Personnel, and Administration reported directly to the DG. Buildings and Properties, and the Computer Centre reported to Administration. As IRRI is now structured (see organization chart, Figure 2.2) a position of DDG for Finance and Administration has been added with separate divisions for Finance, Administration, and Operations reporting to that DDG. Personnel (now called Human Resources Development) is shown as also reporting to the DDG, and the Computer Centre has been moved to the DDG for International Programmes.

In addition to reviewing documents, and meeting with staff and the external auditors, the Panel members held group interviews with NRS members of the Council of IRRI Employees and Management (CIEM), and with the spouses of Internationally Recruited Staff, to gain insight into issues of concern to them.

8.2 Management of Human Resources

Since the previous review IRRI has achieved significant reductions in personnel, primarily as a result of a 27 percent decrease in the core nationally recruited staff (NRS). As of July 1992, IRRI had 2,195 full-time equivalent positions (78 IRS, 15 visiting scientists, 44 postdoctoral fellows, 1,616 core NRS, 221 project NRS and 221 emergency); 91 of these were for internationally recruited positions although only 81 are filled. Table 8.1 indicates statistics on the number of 'position years' that were actually filled in each year. Because of position freezes and delays in filling positions, actual headcounts at any point in time are higher than the number of position years filled.

Internationally recruited staff (IRS) positions that were filled between 1987 and 1991 have risen by eight percent with the increase being in complementary (special project) funded positions. All but one of the overall increases were in research positions. Approved (as distinct from filled) core IRS positions remained at about 73 until 1990 when IRRI began implementing its Medium Term Plan, at which time the number increased to 78. In 1991, only 61 of the 78 (78 percent) were filled because of staff vacancies and shortages in core funds. Both core and special project positions have actually been filled as funds have become available.

Table 8.1. IRS and NRS Positions From 1987-1992.

<u>Internationally Recruited Staff</u>	NUMBER OF 'POSITION YEARS' FILLED					
	1987	1988	1989	1990	1991	1992*
Core	62	67	60	67	61	60
Complementary	10	7	10	12	16	18
Total IRS	72	74	70	79	77	78
Visiting Scientists	11	23	20	17	19	15
Postdoctoral Fellows	n.a.	n.a.	49	45	45	44
<u>Nationally Recruited Staff</u>						**
Core						
Managers/Sr. Asst. Scientists	10	17	17	22	30	29
Asst. Managers/Supervisors	605	612	505	453	472	473
Support Staff	1,595	1,610	1,308	1,206	1,188	1,114
Sub-total	2,210	2,239	1,830	1,681	1,690	1,616
Project	243	274	249	256	267	221
Emergency	295	264	205	213	204	221
Total NRS	2,748	2,777	2,284	2,150	2,161	2,058

*1992 is projected 'position years' that will be filled to year end.

**Actual NRS positions as of July 1992.

The human resources function at IRRI for IRS and NRS is handled separately. The Director for Administration deals with IRS personnel matters directly, while the personnel function for most NRS is the responsibility of Human Resources Development, a unit which operationally reports to the Director for Administration although it shows on the organization chart as reporting directly to the DDG for Finance and Administration. Personnel policies for NRS in IRRI's country programmes are developed and implemented by the country team leaders. In the next section we focus primarily on personnel policy and system matters related to the internationally recruited staff. Section 8.2.3 covers nationally recruited staff.

8.2.1 Internationally Recruited Staff

As of June 1992 IRRI had 81 internationally recruited staff, 61 at Los Baños and 20 elsewhere. Women comprised 11 percent. No one nationality dominated the top administration positions. Internationally recruited staff are of 20 nationalities; groupings by country or region of nationality are:

Table 8.2. Nationality of IRS

	Male	Female	Total
U.S.A.	14	6	20
India	12	-	12
Philippines	11	2	13
Other Asian Countries*	14	1	15
E.C.**	10	-	10
Australia	7	-	7
Other***	4	-	4

*Includes Japan 3, Malaysia 3, Thailand 3, Bangladesh 2, China, Korea, Sri Lanka, Vietnam.

**Includes U.K. 4, Netherlands 3, Germany 2, Switzerland.

***Includes Dominican Republic, Lebanon, New Zealand, Peru.

Core IRS turnover fluctuated between 4 and 11 percent per year between 1987 and 1990, but was 27 percent in 1991. This large increase reflects the culmination of both programmatic and personnel policy changes at IRRI. Because of programmatic changes, positions were phased out for staff whose scientific talents did not match the changed requirements. In 1992 the turnover is projected to be about nine percent. IRS appointments are for fixed terms, usually from 2 to 5 years, and renewals beyond 10 years are reported to the Board. The practice of extending appointments is quite common; as of September 1992, 24 of IRRI's IRS have been at IRRI 10 years or more. At the same time, IRRI has a relatively new cadre of international staff. The median tenure of an IRS in 1992 was 4 years. IRRI commits to provide at least 6 months notice when it does not intend to renew an appointment. The expectation of permanent tenure is no longer encouraged. No present IRS in Administration were in their positions at the time of the last Review.

Scientists are now working on interdisciplinary approaches and know that they may not be with IRRI for an indefinite period of time. In discussions with staff, some concern was expressed about the distraction of needing to keep in mind other opportunities in the event that contracts were not renewed, and the possible difficulty in the future of moving from an interdisciplinary-based organization to institutions that stress disciplinary research. At the same time, IRRI has been successful in recruiting scientists from tenured positions despite this potential uncertainty. It would be helpful

if the Institute could find additional ways of reassuring productive, quality scientists so that their energies are not dissipated needlessly over tenure concerns.

A Performance Appraisal Review system has been established and is central in the development process for staff. The procedure calls for a self-assessment by the IRS including: the preceding year's accomplishments, how those accomplishments match the objectives that had been set individually and collectively for assigned tasks, and the individual's objectives and plans for the year ahead. Principal reviewers, typically Programme Leaders, Division/Centre Heads, Directors and DDGs, evaluate the person's contributions and achievements in the implementation of programmes and projects. The respective DDG makes narrative comments and the IRRI Steering Committee arrives at an overall rating. An important step in the process requires that the DG or appropriate DDG meet with each individual to discuss the review, and to confirm plans and objectives for the coming year. These discussions provide feedback on future plans, programme assignments, and appointment renewal. In the past two years there has been slippage in the process, in part due to the recent arrival of the DDG for Research, and some IRS did not benefit from meetings with the appropriate superior, as specified in the procedures. The Panel believes that this step is crucial to effective functioning of IRRI's personnel system and urges that it not be neglected in the future.

Selection processes for new IRS staff are now similar to those used in academic institutions. Recruitment is based on approved job descriptions, and is generally conducted by search committees. The chair of the search committee presents the committee's views to the DG who makes the final choice. In part, the success of the process is dependent on the quality of the job description so that the committee has a clear basis for achieving consensus. Success also depends on vigorous use of widespread recruitment processes in addition to advertising such positions. Accurate and unbiased reporting of the search committee's views is also important, which is usually best achieved by preparing a written report for all committee members to sign. While supporting the virtues including the transparency of a formal search process, the Panel urges that in its application, IRRI ensure that the brilliant but sometimes idiosyncratic candidate is not lost in the process. And it needs to ensure a significant involvement of Division Heads to maintain continued disciplinary excellence. IRRI's salaries appear to be competitive with those paid by academic institutions, as evidenced by the number of applications currently being received for advertised IRS positions.

The matrix management approach to research, discussed in more detail in Chapter 4, required management training for the research scientists. Several Division Heads mentioned that, in addition, the training had a positive spillover effect on their own management styles.

Since 1987 special project funded staff has increased from 10 (14 percent) to a planned 18 (23 percent) of all planned IRS positions in 1992. Nearly all of this growth has occurred in the past two years. There is some concern about the consequences of shifting the balance between core and special project positions. Special project (complementary) staff tend not to share the same institutional burdens as those on core budgeted posts. Their appointments are necessarily for short terms and one gets

the impression that under these conditions IRRI may have difficulty recruiting as high a calibre of scientists for these posts as for core-funded positions. Four core positions have been frozen and eight slowed down in the recruiting process in 1992, again as a result of funding shortages.

8.2.2 Nationally Recruited Staff

At the time of the 1987 Review IRRI employed a total of 2210 core nationally recruited staff. As IRRI refocused its strategy, the merger of departments into divisions made many positions obsolete. In order to streamline staffing, an innovative special separation programme (SSP) was developed to encourage staff, whose skills IRRI could forgo, to terminate voluntarily their employment. Of the 699 people who applied for the SSP, a total of 416 had left as a result of the programme by the end of 1989. Because of IRRI management's thorough and humane planning, the programme was well received and successful in reducing a large number of positions. No legal cases resulted from the SSP. In addition to the SSP, certain positions were unfilled or abolished in 1989 and 1990. As a result, by July 1992 the core NRS had dropped to 1616, a 27 percent reduction.

In 1989, a job evaluation study was conducted for IRRI by Price Waterhouse. As a result, job classifications were changed from a person- to position-based structure and these were compressed which led to some staff morale problems. Further, recent salary increases have not met the expectations of the NRS, particularly given the current inflation rates. Moreover, many of the NRS who had applied for the SSP but were not offered it, perceived a promise of a better financial future for staying but later felt that this financial promise was unfulfilled. A more rigorous performance evaluation and reward system has been used, adding to NRS concerns.

For budgetary reasons many vacant core positions are being filled internally, providing promotion or development opportunities for existing NRS. However, these internal promotions may come at a cost of limiting the infusion of new required skills into the system and increased job training for employees moving into new areas of responsibility. Some skills can only be recruited from the Manila labour market; IRRI may be decreasing its ability to compete effectively in that market because of uncompetitive salaries.

A Senior Assistant Scientist position, equivalent in rank and stature to the manager of an administrative unit, has been created to provide recognition and an additional step in IRRI's career ladder for qualified NRS researchers; seven Senior Assistant Scientists were appointed in 1992.

Proper management of human resource development (HRD), the function relating to personnel, is critical to IRRI's performance. For reasons that are not fully clear to us, the Institute has found it difficult to attract and retain a head of HRD. Four different people have held the post since 1987. We observed: (a) that at present, HRD management responsibilities at IRRI are scattered among the Director of Administration, the DDG for Finance and Administration, and the HRD Manager, and (b) that in practice the interim HRD Manager is currently reporting to the Director for

Administration on some matters, not to the DDG for Finance and Administration as specified in IRRI's organization chart. We believe that the HRD Manager's effectiveness and job satisfaction could be improved by removing these ambiguities and clearly establishing the authority of the post.

Recommendation 8.1

The Panel recommends that in reality the Human Resources Development Manager report directly to the DDG for Finance and Administration and that human resource management responsibilities be consolidated.

At a later stage, when realignments become possible in IRRI's administration and operations functions, the Panel believes the human resource management functions should be combined for both IRS and NRS, and headed by an internationally recruited staff person.

8.2.3 Assessment

The challenges of human resource management can be expected to increase in IRRI's foreseeable future. We commend IRRI for the creative solutions it is bringing to bear in this area. Continuing attention to the motivation and stimulation of IRRI's excellent national staff is of critical importance. At some point it may become expedient to have even fewer staff to help make certain that those high quality NRS employed can be compensated at fully competitive levels.

IRRI has in place good personnel policies and procedures, clearly written, and readily available to staff. Management is actively pursuing creative and carefully considered responses for dealing with a challenging human resource environment under financially constraining circumstances. For example, we are pleased to note that staff development is receiving increased attention. The Panel encourages HRD to consider how training can be related systematically to career paths for NRS, where appropriate.

For the IRS in research, a combination of demands resulting from the matrix management approach, the increased decentralization of research to off-campus sites, necessary reporting requirements from the CGIAR System, increased requirements for interacting with donors and potential donors, and pressure to prepare special project proposals, is detracting significantly from quality time for research. Regular attention is needed to identify ways of reducing this burden cost. Further, career counselling and development for IRS who are likely to be moving on to environments where interdisciplinary research is less valued than at IRRI needs to be incorporated into the appraisal process.

While the Panel is sympathetic to the constraints imposed by Philippine employment laws, and management's intention of reducing the number of NRS core positions, IRRI's capabilities must not be jeopardized by the present management directive to fill NRS core positions from within the existing core staff pool. IRRI is fortunate in having such a high quality NRS support staff, especially so on the research side, and must be vigilant to maintain a competitive salary structure for them, even at

the expense of reducing the number of positions further. The practice of monitoring market salaries needs to be continued, especially in these inflationary times. For certain skilled positions, IRRI has no alternative but to continue to compete with the Manila market.

8.3 Financial Management

The previous EMR called for reforming the organization and staffing of the Accounting Department; placing high priority on computerization and the formalization of financial system and procedures; and studying the implications of IRRI's heavy dependence on restricted funding on future programme flexibility. The first two concerns have been addressed most effectively by IRRI, but the need for special project funding continues to be a challenge given the economic and political issues affecting the CGIAR System generally. IRRI's management is responding constructively to its shrinking income.

8.3.1 IRRI's Financial Performance

Between 1987 and 1991 IRRI's total funding (Table 8.3) grew in nominal terms from US\$34.9 to US\$40.0 million. In constant 1992 dollars, however, IRRI actually experienced a decline in total funding of 8.9 percent during this time period. The following discussion focuses on the audited numbers for 1987 to 1991; 1992 projected figures are provided to indicate likely trends.

Table 8.3. Sources and Applications of IRRI Funds (US\$ in 000s).

	1987	1988	1989	1990	1991	1992*
SOURCES:						
Unrestricted	8,367	9,339	16,723	18,241	18,659	23,950
Core Self-generated**	1,269	1,764	2,399	1,270	1,731	1,300
Restricted	16,381	16,725	9,500	11,008	11,289	4,358
Core Complementary	8,845	10,953	6,721	9,123	8,293	15,342
TOTAL SOURCES	34,862	38,781	35,343	39,642	39,972	44,950
APPLICATIONS:						
Core - programmes: restricted and unrestricted	24,769	26,722	27,271	27,024	29,098	29,432
Core - capital	1,215	1,070	1,450	3,495	3,963	826
Complementary Programmes	5,089	5,564	7,547	6,540	6,998	7,771
Complementary Capital	-	-	-	2,583	1,296	7,571
TOTAL APPLICATIONS	31,073	33,356	36,268	39,642	41,355	45,600
UNEXPENDED BALANCES	3,789	5,425	(925)	-	(1,383)	650

*Projected for 1992

**Includes interest on short-term deposits and savings

Considering sources of funds, total core funds (both restricted and unrestricted) as a percentage of total funds, increased from 75 percent to 79 percent between 1987 and 1991. They declined as a percentage in 1992 because of the effect of

the one time contribution of US\$6.5 million in 1992 for the building programme. **Unrestricted core funds** have increased from 28 percent of total funds in 1987 to 51 percent in 1991, largely as a result of a reclassification of some contributions into the unrestricted category. This is still less than the average of 69 percent for all 13 CGIAR Centres in 1991. In 1992, the Japanese contribution of US\$6.6 million was reclassified from the restricted to the unrestricted category so unrestricted core funds for 1992 are expected to be about 55 percent. **Complementary funds** (sources) have declined in both actual dollar amounts and as a percentage of total funds received between 1987 and 1991. These funds represent a significant contribution to IRRI's programmes. To cope with shrinking resources IRRI is actively seeking complementary funding while recognizing the restrictive and short-term nature of that source.

Currently IRRI has 26 donors compared with 25 in 1987 and the mix of donors has remained almost unchanged. The top ten donors accounted for 85 percent of core contributions in 1991; the top three continue to provide over 50 percent of these funds, a pattern unchanged since 1987.

Total **applications** (uses of funds) have increased from US\$31.1 million in 1987 to US\$41.4 in 1991, a compounded average growth of 7.5 percent per year. The most striking change has been the increase in core and complementary capital projects which reflects the Institute's commitment to renovating IRRI's physical infrastructure. These funds reflect a significant contribution of DM10 million (US\$ 6.5 million) from the German government for this purpose. Funds applied to complementary programmes have increased significantly since 1987, from US\$5.1 million to US\$7.0 (a net increase of 38 percent) in 1991 and are projected to increase to US\$7.8 million in 1992. Core operations had a negative balance of US\$1.4 million due to the introduction of depreciation accounting in 1991.

In January 1990, IRRI research was reorganized from a disciplinary to a programme basis. Comparisons on the use of funds cannot be made because of these two different structures. From analyzing 1990 and 1991 actual operation expenses, and 1992 projected expenses, and comparing them with data from the last review, it is apparent that IRRI's administration and operations expenses (adding back cost recovery of indirect costs and excluding depreciation) have remained approximately the same since the time of the last review (Table 8.4). An indirect cost study calculated that IRRI's indirect costs are 28 percent for off-campus projects and 42 percent of direct costs for on-campus ones. IRRI is not always able to recover the full indirect cost of complementary projects, perceiving that donors are not willing to pay the actual rate. Since 1990 IRRI has begun raising its indirect cost rate on new projects. However, the end result still remains that unrestricted core donors are implicitly contributing to the funding of some complementary projects, particularly for those carried out on-campus.

Specific attention has been given to **capital expenditures** - upgrading, renovating, and replacing old facilities and equipment. An extensive master space plan has been developed and, during the past four years, major funds accumulated from core (US\$3.7 million) and complementary donor funding (US\$11.9 million). Six major donors were involved. As a result, IRRI has had a major facelift, enabling it to operate with less disruption.

Table 8.4. IRRI Operational Expenditures, 1990-1992 (US\$ in millions).

	1990 Actual	Percent	1991 Actual	Percent	1992* Projected	Percent
Research Programmes	\$ 14.9	55.2	\$ 13.6	46.7	\$ 14.6	50.3
International Programmes	7.1	26.3	8.2	28.2	7.1	24.5
Administration	3.8	14.1	3.9	13.4	4.4	15.2
Recovery from indirect costs**	(0.8)	(3)	(1.3)	(4.5)	(0.7)	(2.4)
Operations	2.0	7.4	2.9	10.0	1.8	6.2
Depreciation	-	-	1.8	6.2	1.8	6.2
TOTAL OPERATIONS	\$ 27.0	100%	\$ 29.1	100%	\$ 29.0	100%

*Projected for 1992

**Numbers in parentheses are subtractions

IRRI's **liquidity** (current assets/current liabilities), its ability to meet its short-term obligations, is adequate; between 1988 and 1991 the current ratio has fluctuated between 1.44 and 1.61 while the quick ratio (current ratio excluding inventories) was 1.38 at the end of 1991. IRRI has not had to borrow funds (except for the one time Special Separation Programme) which is also a useful indicator of liquidity. Working capital has been equivalent to about 32 days of the operational budget during the time period under review. Cash is invested in fixed deposit and custody accounts with Citibank and Deutsche Bank generating interest at prevailing market rates. Because of low current market rates on US\$ deposits the Panel suggests that IRRI consider other risk-free investments.

8.3.2 Organization and Staffing

The present Director for Finance joined IRRI in late 1987, shortly after the previous Review. The Finance Department was restructured under his leadership, with strengthened managerial and supervisory levels. At the same time reductions in staff were achieved. A manual documenting the organization and functional responsibilities of the Finance Department has been written. As a result of the reorganization and successful implementation in 1990 of a computerized financial management system and the adoption of the project management system, most of the financial policies, procedures and systems were revised or rewritten. Each unit within Finance has prepared user manuals, documenting policies and procedures for its area.

The new system has supported the Institute's move to project management and the matrix structure. A manager position for (computer) financial systems is housed in the Finance Department.

Attention has been given to staff training to enhance computer skills and to maximize the benefits of the Financial Management System. The Institute experienced some difficulty in filling its key manager positions in Finance, in part because of IRRI's location. In the past IRRI's advantage has been its competitive salaries. This competitiveness must be maintained for both recruiting and retention purposes. IRRI is particularly vulnerable in the accounting area because of strong competition in the Manila market.

8.3.3 Financial Planning, Budgeting and Control

Budgeting at IRRI has moved from a top down to a more bottom up approach, which is consistent with the previous review's recommendations. The process follows well defined budget guidelines and approval processes. Project-based budgeting, accounting and reporting systems support the financial planning, monitoring, and control of expenditures. The computerized Financial Management System has enhanced significantly financial control and efficient use of resources.

The budgeting process for each of IRRI's five research programmes is initiated at the project level, where the Project Coordinator, together with the relevant Division Heads, Programme Leaders and the scientists, determines human and financial resource requirements using predetermined budgeting guidelines, planning figures, and forms. International Programmes go through a similar planning and budgeting process that involves staff, and centre or unit heads.

Improved procedures, control mechanisms, and cash management have resulted from restructuring and strengthening Finance staff, internal and external reviews on many aspects of the operations, and rationalizing systems in the course of implementing the Financial Management System package. On a timely monthly basis, financial reports are provided to users by programme, sub-programme and project. Staff time allocations (using salaries and benefits of both scientists and support staff) are costed to projects within programmes. General operating costs are also reflected by project. The new budget, accounting and reporting systems provide the required planning, recording, and feedback on operations. Scientists report a high level of satisfaction with the transparency of their budgets and their understanding of the financial status of their projects.

8.3.4 Auditing

Since the last Review IRRI has been subject to ten operational reviews, six special audits by donors, two overhead audits, and three efficiency audits, in addition to regular audits stipulated by some donor contracts, and the usual external and internal audits. These audits and reviews reflect well on IRRI's operations; recommendations stemming from audits have generally been implemented promptly.

The **internal auditing** function has improved further since the last Review. The Internal Audit Office was reorganized in 1990, resulting in the creation of three sections: financial, operations, and electronic data-processing. The total number of auditors increased from six to eight. Also beginning in 1990, the internal auditor began meeting with the DG on a monthly instead of a quarterly basis, and meeting twice a year with the Audit Committee of the Board, in the absence of Management, to discuss accomplishments, work plans, and any items needing to be brought to the Committee's attention. Management has responded in a timely way to internal audit recommendations. On occasions when no qualified staff is available to do specific planned audits, the work is contracted out to external accounting firms or consultants. IRRI's inability to recruit and retain an electronic data processing (EDP) auditor is of some concern to the Panel although we understand that management recognizes the importance of filling this position. The external auditors attribute the difficulty to IRRI's location in Los Baños and the lack of a competitive salary level.

In 1990 the **external audit** firm was changed to Price Waterhouse from Sycip, Gorres, Velayo (SGV) who had been the auditors since IRRI's inception. The change was made to bring a fresh perspective to IRRI's financial operations. The audit is performed in a timely manner; the auditors believe that management and the Board have been responsive to concerns raised in their management letters. With the CGIAR requirement that all Centres depreciate capital assets, beginning in 1991, IRRI's financial statements are in conformity with generally accepted accounting principles.

8.3.5 Assessment

Since 1987, IRRI has vastly upgraded its financial structure, procedures and systems. With an integrated computerized Financial Management System in place, the Department has demonstrated its ability to support a transparent, rational budgeting process, monitor expenditures, undertake cost analyses, and provide timely reporting throughout the Institute in ways that are appreciated by administrators and researchers alike. From interviews with staff, our own observation, and meetings with the internal and external auditors, the Panel concludes that IRRI has in place sound financial reporting and control systems. Future challenges will be to adjust IRRI's fixed costs as the Institute's programme adapts to a likely smaller financial base. The Department is well served by its Director who has proven to be a valuable resource to IRRI both in the Institute's current operations and as it plans for its future.

8.4 Administrative Services

8.4.1 Food and Housing Services

The Food and Housing Services (FHS) manages and operates a cafeteria, a snack bar, the Executive Dining Room, the Guesthouse, four dormitories, 55 IRRI-owned staff houses, 35 IRRI-owned apartments, 6 leased houses, a laundry, and the swimming pool. An additional three cafeterias are contracted out and managed by Human Resources Development. FHS is budgeted as a self-sustaining operation. As a consequence of training being moved into national programmes and of trainees and their

families choosing to stay off-campus rather than in IRRI facilities, dormitory usage has declined. As a result, the FHS began operating at a deficit in 1991. Short-run steps including increasing prices and reducing costs, are being taken to achieve a break-even position, but in the longer run alternative uses of some of the space for other purposes is being considered by management. Several consultancies have been conducted. FHS and HRD also conducted user surveys of food services to obtain feedback for planning purposes.

The quality of the service provided by the FHS is high. The facilities are attractive and spotless, the meals are varied, tasty and, in the dining rooms, beautifully presented. The staff at all levels exhibits a high degree of professionalism in their work.

8.4.2 City Office, Communications, Travel, and Central Files

These four areas are the responsibility of a single Manager, so are dealt with together in this section. The **City Office**, located in Makati, handles all of IRRI's errands in Manila. A car travels back and forth between Manila and IRRI once a day, six days a week, transporting items and mail. IRRI maintains a Manila Post Office address to ensure greater postal timeliness and, except for local Los Baños mail, IRRI's outgoing mail is delivered directly to the Manila Post Office. **Communications** includes the mailroom (sorting incoming mail, delivering and retrieving mail on campus, handling outgoing shipments and taking local mail to the university post office), telephones, telex, fax, and managing the contracted out maintenance for photocopying equipment on campus. Additional direct telephone lines to IRRI have been installed recently to respond to the difficulty of servicing incoming and outgoing calls.

IRRI employs one travel officer who handles staff travel authorizations, but other travel services are contracted out, as a result of a competitive bid, to Thomas Cook which maintains an office at IRRI. **Central files** serves an archival function for files and personnel records. This unit has recently been given upgraded equipment and is in the process of automating indexes to its records. A microfiche system is being reviewed currently for possible future adoption. Its retention policy and procedures do not appear to be widely communicated in the Institute; and consequently, many older files that could be lodged in single copies there remain duplicated throughout IRRI offices. It appears to be used primarily by the Director levels and up.

8.4.3 Visitors and Community Services

Each year IRRI hosts approximately 30,000 visitors, the largest segment being school children. IRRI views these visits as an important public relations activity, reaching not only to students but farmers, agricultural technicians, government officials, donor representatives, ambassadors, and cabinet ministers as well. Existing space is being renovated to create a Visitor's Centre where they can be oriented with informative displays and minimal interruption to IRRI's research workers. The Visitors and Community Services unit also provides effective logistics support for meetings, conferences and workshops held at IRRI.

8.4.4 Materials Management

Materials Management is responsible for sourcing and procuring local and foreign materials, planning material requirements and controlling inventory, and receiving, storing, issuing and disposing of stock items. This unit has experienced substantial problems in performance, of which management is aware. A systems audit was undertaken in 1991 followed by a contract with a consulting firm to streamline the unit's organization, systems and processes. That work is still ongoing. Accomplishments to date include the definition of job functions and job descriptions, the realignment and training of staff, reductions in corruption, inventories and procurement response times, implementation of a materials planning and control system, and providing regular monthly feedback to users on the status of orders.

Continued attention needs to be paid to the interfaces between materials management, finance and research. As the Institute proceeds in its work in this area, the critical importance of timely availability of required research materials to the research process must be a foremost consideration. At the same time, an understanding by the end users of the need for, and a commitment to, materials requirement planning is also important.

8.4.5 Security and Safety

IRRI has a history of difficulties with security and theft including loss of valuable items from staff housing and pilfering. At the time of the previous Review a study had just been completed by IRRI's auditors and the Audit Committee of the Board. Security remains a problem.

IRRI's campus is difficult to secure as it is a relatively large piece of property that is not well fenced, traversed by public access roads, and with staff housing scattered in several locations. The IRRI security staff is firmly entrenched (the most recent one hired was in 1979) and formed into cliques and competing factions. Leadership is poor. Opportunities exist for improvement in that the Manager's position is currently vacant and an excellent review has just been completed by Pinkerton Consulting Services. We urge IRRI management to consider and act on the Pinkerton report in a timely fashion.

Recommendation 8.2

The Panel recommends that the Chief Security Officer position be filled by a person from outside of IRRI's present staff and that IRRI increase the proportion of contract security officers among its security staff.

IRRI's recent experience with two major fires served as an important reminder of the continuing importance of adequate safety measures. The Safety operation is responsible for administering the Pesticide Applicator's Safety Programme, conducting safety inspection of laboratories, workshops, and offices, preparing safety reminders, conducting drills and sponsoring clean-up day activities. From visual

inspection we conclude that these monitoring activities are being carried out. Recent publications have been prepared on the IRRI Fire/Disaster Control Programme procedures, and revised Guidelines for Authorized Pesticide Applicators.

8.5 Operations

The Operations Division consists of Physical Plant Services, Transport, and the Central Research Farm. The Central Research Farm is discussed in Chapter 3.

8.5.1 Physical Plant Services

Physical Plant Services has evolved out of the Buildings and Properties (B & P) section, which previously reported to the Director for Administration. Whereas B & P had a work force of 255 core employees, PPS now has 136 people. PPS was placed under the Director for Operations to provide better control and more cost-effective approaches to maintaining and rehabilitating an aging plant. Many IRRI buildings were constructed in the early 1960s, and their condition had deteriorated. Since the last review, a master plan on space allocation was developed which addressed both rehabilitation of existing buildings and the construction of additional facilities. The plan delineated research, administrative support, and public function zones.

Considerable progress has been made in the implementation of the plan. More than US\$15 million has been raised for construction and renovation funds, as described in the finance Section 8.3.1. A substantial amount has been completed and more is underway. The urgency of replacing deteriorating electrical systems was underscored by a major fire in Chandler Hall, sections of which have now been rebuilt. Rewiring of older IRRI buildings and installations is an ongoing priority. A more certain supply of electricity for IRRI's essential facilities has been achieved by upgrading the electrical distribution system and power plant. Appropriate containment facilities have been planned and await government approvals for an environmental study before construction can begin. The monitoring and follow-up of scheduled work is facilitated by a computerized work order/maintenance request management system. Evidence of the successful rehabilitation and building programme is all around. Much of the success of the building and rebuilding programme can be attributed in the first instance to the DG's ability to raise the required funds and to the leadership and direction provided by the Director for Operations. In collaboration with UPLB, IRRI is developing and will operate a joint landfill waste disposal system that includes recycling and composting components.

8.5.2 Transport

In order to upgrade the quality and quantity of service and to use a smaller staff more efficiently, the Motor Pool and the Motor Vehicle Repair Shop were transferred to the Operations group and merged into the Transport Office. The Motor Vehicle Repair Service handles all related activities, and as a result builds a maintenance record on each vehicle, rationalizing parts purchase and replacement. The Motor Pool Dispatching Section is responsible for scheduling staff and vehicles. It is beginning to

automate some of its processes. The Panel suggests that the Section explore the feasibility of using a linear programming package to assist in scheduling assignments. A recent study has recommended that transport costs be charged back to the units making use of its services. Providing these data would assist staff in making decisions on using vehicles and would provide comparative data to evaluate Transport's competitiveness with alternative suppliers.

8.6 Computer Services

Organizationally, computer services is within International Programmes. It serves institute-wide needs - in research support, database construction and management, the library, administration, telecommunications, operations, and some aspects of finance (which also has its own Systems unit). Placed structurally within the Information Centre, the unit functions successfully in a relatively autonomous mode, although in somewhat of a management vacuum.

IRRI made the decision to run its financial and administration systems on a separate hardware platform (IBM) while research operates on a Digital VAX. The installation of a gateway between the two systems is planned for 1992. Computing support services at IRRI have shifted from solely centralized mainframe facilities to a decentralized Local Area Network (LAN) accessible through personal computers. The Institute plans to have all major buildings connected by the end of 1992. Other users can connect via modems. The Oracle relational data-base management system is installed on the mainframe and statistical analyses packages are available to staff using personal computers. In almost every area examined in this review, computerized tracking systems have been or are in the process of being developed.

As CGIAR Centres generally move to LANs, the use of software will become an increasingly expensive item. Software is an intellectual property, governed by copyright principles. Some countries, including the Philippines, do not recognize copyright on software. However, as an international organization, IRRI should consider operating within internationally agreed upon standards. A possible solution could be for the CGIAR Centres collectively to obtain licensing on strategic packages to minimize expenses.

A Wide Area Network has been implemented using the microwave transmission facility that was installed in 1989; this is being used to provide a facsimile link to the NARS. A connection to the DATANET packet switched data network allows both outgoing and incoming traffic, including remote access from some NARS sites. As telecommunications technology is emerging IRRI is forced to operate using dual communication systems, one to communicate with universities in developed countries and the other to communicate with the majority of the NARS. A positive trend is the expanding use of INTERNET by universities in developing countries.

The new infrastructure offers IRRI scientists and administrators the potential to manage their own information systems more effectively, and to communicate

with each other and the external world more productively through international networks such as BITNET, INTERNET, and CGNET.

We assess the Computer Services unit as performing well at both an operational level and in innovative planning for the future. The Computer Manager functions as an important technological resource for the Institute, maintaining currency in his field, actively identifying user needs and generating cost-effective solutions in hardware, software, applications, telecommunications, and related technologies.

The Panel concurs with the conclusion of the recent Sloan Fellows report that the current organizational positioning of the Computer Services unit does not reflect the central, strategic importance of information systems to the Institute as a whole. While the ability to function semi-autonomously has advantages, these are outweighed by the benefits that would be obtained by being linked into the organization and having access to management direction. In making its recommendation, the Panel considered where the unit could best serve the organization in view of the broad nature of constituencies that the function serves, and its role in future telecommunications and systems planning. The Panel suggests that the Computer Services Unit report directly to the Deputy Director General for Finance and Administration.

8.7 Overall Assessment

IRRI's infrastructure has been reduced in size but strengthened in quality to provide administrative and operational support to the research functions of IRRI. Most marked changes can be seen in the financial and computer systems and the improvement in physical facilities.

Many internal and consultant reviews have been undertaken to improve processes and achieve cost efficiencies. Further steps need to be taken, particularly in purchasing, materials management and security. Management is aware of and responding to the opportunities for improvement.

It is not a truism to say that IRRI's most valuable assets are its human resources. While there is a continuing need to reduce staff redundancies and seek the most efficient and cost-effective way of providing services, at the same time continuing attention must be paid to motivating, developing, and rewarding outstanding staff. It is important that the human resource function at IRRI be clarified, supported, and clearly valued. There is a widespread perception among NRS that IRRI is losing, or has lost, its competitiveness in staff salaries and benefits. To the extent that management can document and publicize its competitiveness, it should do so. The importance of communication with staff cannot be over valued. IRRI management is commended for the efforts it is taking to understand and respond to staff needs. If IRRI becomes unable to be competitive because of a lack of financial resources, it may be forced to cut back some of its work in order to pay a smaller staff competitive salaries.

Considerable management attention is being given to controlling costs. When resources and services are 'free' goods, they tend to be used inefficiently or even wasted. The Panel concurs with recommendations put forward to 'charge back' internal costs in the Institute along with giving staff the option of purchasing the service elsewhere if IRRI cannot perform competitively. When users are aware of costs they are in a position to make informed, responsible decisions. When providers of a service do not have a monopoly they can measure their performance by market demand.

As IRRI's transformation in its strategy, structure, systems, and physical facilities proceeds, and with the likelihood of further decentralization of research as it pursues an ecosystems approach, we can see that a time will come during the next five-year period to reconsider the organizational reporting structure for the top management positions in Finance, Administration, Operations and Human Resource Management (see Sections 7.3 and 8.2.1).

CHAPTER 9 - CONCLUSIONS

This chapter presents the Panel's overall conclusions about IRRI as an institution: its past, present, and future. We discuss in turn IRRI's major accomplishments and impact, its strengths and weaknesses, its current strategic directions, its future role in rice research, and its future role within the CGIAR.

9.1 IRRI's Major Accomplishments and Impact

Among scientists and agricultural leaders in both developing and industrialized countries, the panel found a uniform judgment that IRRI has been a highly productive research Centre. The Panel shares this view. We cite five types of evidence.

First, beginning with IR8, IRRI has produced a long series of high-yielding rice varieties and breeding lines. Over the years, these have incorporated ever-improving elements of grain quality, short duration of growth, resistance to plant diseases and pests, and adaptability to different ecological settings. These varieties and breeding lines have been used widely in rice-growing countries around the world.

The modern, high-yielding varieties and associated farming practices developed by IRRI and by national research systems have had a very large impact on rice yields and production. In Asia, production doubled from 1966 to 1990 - a rise in annual totals from 240 million tonnes of paddy to 492 million tonnes. Prior to 1976, one-third of the gain came from increases in cropped area; from 1976 onward, almost all of it came from increases in yields.

Increases in rice output have benefitted the farmers who produced it. They have also benefitted consumers; rice production has not only met the demands resulting from population growth and rising incomes, but has been large enough to result in a downward trend in real rice prices over the last twenty years.

Second, the evidence beginning in the late 1960's of striking increases in yields from high-yielding varieties was a major influence in changing the perception of agriculture in developing countries. IRRI rices - along with CIMMYT wheats - demonstrated to policymakers in developing and industrialized countries alike that agriculture in the developing world could be a productive and dynamic sector of the economy, not a stagnant, backward drag on national development.

This change in perception resulted in major increases in the priority and the resources given to agriculture in national development plans and in donor programmes. These positive changes in policies toward agriculture, even though adopted unevenly in the developing world over the last twenty-five years, have brought large benefits to many millions of people.

Third, as a result of the early successes of high-yielding rices and wheats in the green revolution, national governments began to pay much more attention to their agricultural research systems, and IRRI has had a sustained and important impact in helping to strengthen national rice research. IRRI has helped to train some 7000 rice scientists and technicians from all parts of the developing world, among them many who are currently research programme leaders in their own countries. IRRI's collaborative research activities have helped to establish and raise standards of quality in national research systems. In some cases, IRRI has undertaken specific projects of institution-building to help strengthen agricultural research in particular countries. The national systems visited by the Panel were generous in their praise of IRRI's past work and strongly desirous of continued collaboration.

Fourth, IRRI has pioneered in numerous research fields related to rice beyond the continuous effort to raise rice yields. For example, IRRI has pioneered in studies of the economic and social impact of higher-yielding rice varieties. The Institute has been a leader in designing and introducing integrated pest management methods for rice-growing areas in developing countries. IRRI recognized early, and has led the way in studying, the significance of gender differences in rice production and in the distribution of the costs and benefits of new rice technology. These and other examples that could be cited testify to IRRI's admirable and sustained efforts to bring the latest scientific methodologies to bear on issues relevant to rice, and to help introduce those methodologies to IRRI's research colleagues in national systems.

Fifth, IRRI has played a major role in helping to create and sustain a global system of rice knowledge. Through INGER, through its compilations of data, through its training programmes, conferences, publications and in many other ways IRRI has contributed greatly to the development of a world-wide community of scientists concerned with rice and in continuous connection with one another.

These five types of evidence support the Panel's judgment that IRRI, in its thirty years of existence, has had a very large favourable impact on the world's rice farmers and rice consumers. On the other hand, there are important qualifications to the record of success.

First, the effect of IRRI's work has been highly uneven. IRRI's impact, so far as rice farmers are concerned, has been concentrated on the irrigated half of the total rice-growing area and some of the more favourable rainfed lowlands. Farmers in most rainfed areas have benefitted relatively little from IRRI's work.

Second, the large jump in the yield ceiling achieved early on with IR8 has not been significantly bettered in the twenty-five years since. This means that for many rice farmers who are already using the best varieties currently available there may be

little more to gain until the yield ceiling is pushed up again - which has turned out to be a difficult research task.

Third, in intensive rice production, total factor productivity has been declining, which means that steadily more plant nutrients must be provided to the crop per unit of output. Moreover, on some intensively cultivated rice lands, including some of those on IRRI's home campus, yields have been steadily declining. These observations offer disturbing evidence that present intensive rice production systems may not be sustainable over the long run, and point to very important questions of research priorities for IRRI.

Fourth, there have been negative consequences for some people resulting from the adoption of new varieties and improved production practices. For example, women in many traditional settings who earned money processing harvested grain have been displaced by machinery used by men. For another example, in some cases there has been damage to the health of men and women rice farmers who use dangerous pesticides without proper precautions. To IRRI's credit, its own studies have contributed substantially to the identification of these costs and problems.

The Panel's net judgment is that IRRI's accomplishments and impact have been heavily positive, especially in contributing to the huge growth in rice production over the past three decades. Consumers and farmers with assured water supplies have been the principal beneficiaries; farmers in less favoured environments have benefitted much less. Experience has revealed new scientific issues of very great importance, particularly the long-standing plateau in the yield ceiling and the decline in factor productivity in intensively cultivated areas. Finally, it has become amply clear that some groups in societies where new varieties and cultivation methods are introduced may suffer adverse consequences.

9.2 The Last Five Years

In the last five years, IRRI has undertaken a radical transformation. This process has not yet been completed. As described more fully in earlier chapters, this transformation has included:

- a substantial and desirable shift of research resources toward the problems of farmers in resource-poor environments;
- the adoption of ecosystem-based research programmes with both germplasm and resource management objectives and strong scientific links with national systems;
- the introduction of a new research management system - matrix management - that is a sharp departure from the previous system and, in the Panel's judgment, a significant improvement;

- a turnover of approximately 50 per cent of the internationally-recruited staff, while maintaining, in the Panel's judgment, a high overall level of scientific quality;
- a reduction in nationally recruited staff by 25 per cent, accomplished in a sensitive and humane manner;
- major improvements in the personnel, finance, and administration systems and in IRRI's plant and equipment; and
- radical improvements in the organization and functioning of IRRI's Board of Trustees.

It is evidence of IRRI's strength as an institution that it has been able to move forward with such large and far-reaching changes. The Board of Trustees and the management of IRRI have set and held to new policies with firmness and determination, and international and national staff at all levels have sought to carry them out with admirable dedication. It is not possible yet to judge the long-term outcome, but the early evidence is that IRRI may have been substantially rejuvenated, as was judged five years ago to be necessary. In Chapter 3 we report our judgment that while there have certainly been setbacks to the research activities as a result of the transformation, nevertheless through these recent years there has continued a considerable flow of research results, among them the following:

- interdisciplinary work among breeders, physiologists and modellers to produce an improved plant type and associated management system that is expected to raise the yield ceiling;
- development of an interdisciplinary approach to the yield decline problem that is providing a better understanding of the research needed for its solution;
- establishment at IRRI of high quality biotechnology research that has made rapid progress in tissue culture, gene mapping and linkage studies, and the development of techniques for the regeneration of plants from protoplasts;
- continuing gains in the transfer of pest and disease resistance genes from wild rice species.

At the same time, the previous chapters have amply documented serious concerns at the present stage of IRRI's reconstruction:

- the increased emphasis on research in difficult environments, and the consequent decentralization of research to sites away from Los Baños, requires a larger share of IRRI's research to be conducted in collaboration with national systems; while the national systems welcome this prospect, collaborative research is inherently more

complex to organize and accomplish, and calls for institutional innovation, travel, and other time-consuming processes that have placed large new demands on scientific staff;

- multidisciplinary ecosystem-based research, managed through a matrix system, is considerably more complex than the previous model, and requires more time to be spent on paperwork and in consultation and conference, adding to the demands on scientific staff;
- these new demands on IRRI scientists are occurring at a time when many newly arrived staff members are still settling in to the IRRI research environment, and at a time when IRRI's core budget is being reduced;
- moreover, in order to finance its desired research programme at a time when core budget is declining, IRRI has increasingly relied on special projects, which require more time for project design, proposal writing and negotiation, and reporting, per unit of funds obtained, than do core funds.

For all these reasons, the Panel found an extraordinary level of pressure on IRRI's senior research managers, from the Director General through his Deputies to the programme leaders, division heads, and project coordinators. Scientists always, and properly, begrudge time spent on research management, but the extra management demands of new programme objectives and management systems seem to the Panel so heavy as to risk serious cost to research progress. The Panel was assured by a number of IRRI's scientist-managers that the demands of the matrix management system are better understood and being met with less strain than was true a year ago. Moreover, virtually all of IRRI's scientist-managers believe the benefits of matrix management outweigh its costs. Nevertheless, the Panel regards the extraordinary demands on IRRI's scientific management as a major challenge to the institution at present, and we have suggested specific actions to improve the situation:

- initiating a concerted effort to improve the efficiency of operating the research programme in a matrix mode;
- providing the Divisions more authority to further their disciplinary capabilities and, in general, increasing the emphasis on scientific quality and disciplinary excellence;
- delegating greater autonomy to the managers of projects;
- avoiding 'tight coupling' of International Programmes with Research Programmes;
- exploring ways of improving the design and management of research consortia and networks.

In summary, IRRI has demonstrated that it is a strong and resilient organization, which has been able to embark on new programme objectives and a new research management system, with a largely new set of scientific leaders. Its principal weakness is that its scientist-managers are currently overstretched; they need time, understanding support from Board and top management, and a careful measuring of how much is to be asked of them.

9.3 Current Directions

Since the last external reviews in 1987, IRRI has prepared a strategy statement - *IRRI Toward 2000 and Beyond* - that is a significant departure from past practice in several important respects. We comment on three of these here.

First, in its new strategy IRRI has deliberately chosen to pursue equity objectives as well as total rice output objectives. Recognizing that its past work has benefitted principally farmers in favourable environments, IRRI now has committed itself to addressing rice production problems in less favourable environments. This creates an immediate issue for resource allocation: to what extent should resources be allocated to maximize benefits to poorer farmers, and to what extent should they be allocated to maximize rice production to the general benefit of consumers?

In practice, IRRI has given strong priority to expanding rice production. Of the four ecosystems, the two least favourable ones - the upland and deepwater/tidal wetland rice areas - are given some 17 per cent of the 1992 research budget, while 58 per cent of the budget is going to the more favourable environments - the irrigated and lowland rainfed areas.

The Panel supports these priority choices. We are deeply impressed, as we have indicated earlier, by the urgent scientific challenges of raising the yield ceiling and, especially, understanding and reversing the decline in factor productivity. Those are scientific issues central to the production of food needed for the world's growing population and the sustainability of the resource base for the bulk of the world's rice production. We believe that at present this requires the allocation of the great majority of IRRI's research resources to the production problems of the more favourable environments - although solving those problems for favourable environments will obviously carry spin-off benefits for other areas as well.

At the same time, we think it is sound for IRRI, with a smaller share of its resources, to undertake research, guided by equity considerations, on rice in less favourable environments.

Second, in its new strategy IRRI has committed itself to ecosystem research - that is, to understanding and improving production systems in an ecological framework. Part of what this will require of IRRI is reasonably clear - for example, breeding rices that will tolerate better the stresses of drought and temporary submergence. But part of what ecosystem research will require of IRRI is not at all clear, because an ecosystem requires understanding simultaneously as a biological and as a social entity, and there

are few if any reliable methodologies as yet for such work. IRRI scientists addressing ecosystem research recognize that they must proceed on two pillars, germplasm on the one hand, and resource management on the other. To do this effectively will take the joint work of biological, physical, and social scientists and the development of new methodologies - new for IRRI and perhaps new for the world.

In our review, we have been well impressed with IRRI's growing use of new research methodologies. Simulation modelling, biotechnology, geographic information systems, quantitative pest ecology - these are all examples of research techniques IRRI is actively working to apply to rice problems, and to share with colleagues in national research systems.

We applaud, therefore, IRRI's commitment to the difficult task of conducting research in an ecosystem framework, and we have been impressed by the energy and imagination IRRI's scientists are bringing to these tasks. At the same time, we emphasize that, as TAC has said in its 1992 Priorities and Strategies paper, there is as yet no satisfactory paradigm to guide research on resource management. Consequently we believe the wise course for IRRI is to proceed carefully, with its national colleagues, to address primarily research issues related to difficult environments for which methodologies are in hand, and that promise to yield results not limited to the specific site where the research is undertaken. And we urge all of IRRI's stakeholders - Board, donors, national collaborators, fellow scientists around the world - to recognize that results are unlikely to come quickly.

Third, IRRI's new strategy necessarily requires more off-campus research and more collaborative work with NARS. The national systems, in the Panel's experience, welcome both IRRI's new emphasis on rice in unfavourable environments and IRRI's new stress on collaborative research through consortia. We urge that such consortia should incorporate the best of IRRI's (and others') experience. In particular, we have noted the valuable example of the Simulation and Systems Analysis in Rice Production (SARP), a network the purpose of which is to encourage research using advanced methodologies, so that the collaborators in the network are at the same time doing pioneering research and learning new research techniques. This approach is highly attractive to some of the best young scientists in the national systems. It is also highly rewarding to IRRI scientists who themselves are simultaneously helping to advance research and to expand the reach of the methodology. And it links both IRRI and national scientists with advanced institutions in industrialized countries.

For these reasons, we urge that strong elements of seeking and testing new methodologies be built into each of the new consortia. This will not only make them more attractive to national scientists, but will reflect accurately IRRI's objectives both to do research and to strengthen national research systems.

9.4 IRRI's Future Role

With rice production rising, and research capacity growing steadily in national systems, is IRRI needed longer? The Panel strongly believes that it is, for the following reasons.

Demand for rice will continue to grow rapidly as world population continues to rise to an estimated 6.7 billion by 2005. Making allowances for the changing share of rice in diets, and for changes in demand related to income growth as well as population growth, world demand is expected to rise to about 680 million tonnes of paddy by 2005, roughly a 45 per cent increase from 1988.

Increasing rice production by these amounts is not a simple matter of continuing past research and application patterns. On the contrary, rice research has encountered a number of exceptionally difficult scientific problems: raising the long-standing yield ceiling; finding the keys to sustainability in intensive rice cultivation; learning how to combine germplasm and resource management research to the benefit of rice growers in more difficult environments; protecting past yield gains by finding new sources of resistance to pests and diseases and of tolerance to stress. These are first-rank scientific challenges. To make headway on them will require mobilizing the best scientists in industrialized countries, in international centres, and in developing countries.

In the Panel's view, IRRI has a crucial role to play in meeting these challenges, not because of its size - by world standards it is not a large research centre - but because of its strategic opportunities for intellectual leadership. Through its close links with national systems, it can help identify and address the most serious problems of rice farmers. And through its links with advanced research centres, IRRI can bring to bear on rice, and help introduce to national rice research systems, the most modern of scientific methodologies - as it is currently doing with simulation systems and with biotechnology. IRRI's own research, if it is to play this leadership role, must continually incorporate new methods and new techniques as they become available. But it is not simply IRRI's own research, but its manifold communication and collaboration connections that permit IRRI to lead and energize the much larger scientific thrust that will be required to meet on a sustainable basis the growing world demand for rice.

The Panel has identified one of the most difficult scientific challenges - the problem of yield decline and declining factor productivity in intensively-managed irrigated rice lands - as warranting an exceptional effort. We have recommended that IRRI take the lead in organizing an international effort on this crucial problem, enlisting the best scientists around the world. The problem is clearly of a scale and complexity that could not be met by re-allocating IRRI's present resources. Extra funds and extra staff, for IRRI and for other scientific groups that would be part of this effort, will need to be sought for a period of years, probably extending for at least the rest of this decade.

By suggesting an exceptional effort on the problem of yield decline, the Panel does not mean to downgrade the importance and urgency of IRRI's work on other high-priority research objectives. Indeed, while a detailed budget review was not part of our terms of reference, we believe it is appropriate for us to express a sense of

concern about the scale of resources available to IRRI at present, and particularly the prospect that those resources may decline somewhat over the next several years. It appears to us that IRRI is having to economize beyond the point of potential effectiveness, especially if near-term results are expected from the work on more difficult ecosystems.

The Future Role of IRRI Within the CGIAR

The Panel has considered three issues concerning the future role of IRRI within the CGIAR system.

The first relates to IRRI's role as the System's global commodity centre for rice. To the Panel, the term 'global commodity centre' means not simply that IRRI should be a world repository for rice germplasm, but as we have noted above, that IRRI should address - and lead co-ordinated attacks on - the most difficult research issues affecting rice. To fulfil this responsibility, IRRI must lead the way in solving the hardest scientific problems, such as the yield ceiling, blast, sustainability, and the decline in factor productivity. IRRI cannot and should not, of course, expect to deal with such major issues alone. They require coordinated assault from scientists in industrialized countries, in IRRI and other CGIAR centres, and in the national systems. IRRI's indispensable role is to organize and lead such combined efforts.

IRRI plainly accepts the responsibilities of being a global commodity centre, and its present strategy is more appropriate to that role than in the past. By committing itself to research on all rice-based ecosystems, it has undertaken to address the full range of equity issues more deliberately than in the past, and to address more explicitly than before issues of sustainability and resource management.

A second issue is IRRI's geographical range. The Institute's central concerns, plainly, are with Asia because of its predominance on the world rice scene. IRRI has in Asia a rich base of experience, long-standing and effective collaborations with national research systems, and a coherent if not compact travel and communications area. Clearly IRRI should continue to give the bulk of its attention to rice in Asia.

In Latin America, where three per cent of the world's rice is produced, there has been a long-standing rice group at CIAT, which has collaborated successfully with Latin American and Caribbean countries interested in rice. IRRI has served as a valuable back-up for the CIAT rice group, and has one staff person stationed at CIAT who coordinates the Latin American section of the world-wide germplasm evaluation network (INGER). In the Panel's view, these relationships are suitable and productive and should continue.

Rice in Africa is quite another story. Three international centres - IRRI, WARDA, and IITA - all have some role with respect to rice in Africa, where two per cent of the world's rice is produced. IRRI has country projects in Egypt and Madagascar, aiming to assist the strengthening of national rice research systems, and has been considering the possibility of providing assistance to capacity-strengthening in Eastern, Central and Southern Africa through a regional, not a country project. IRRI

also has one staff person stationed at IITA who is the coordinator for the African section of INGER. WARDA is a regional rice research centre for West Africa, with close links to the national systems in that region. IITA had a rice research capacity some years ago, but this was transferred to WARDA in 1990. At present, IITA offers a base for WARDA's rice improvement research for the lowland valley farming systems.

Clearly there are important questions about the roles of the different centres involved in rice in Africa, and to examine and offer recommendations concerning them is one of the main charges to the Inter-Centre Rice Review Panel. We leave to that Panel the sorting out of roles south of the Sahara. We do venture the opinion, based on a visit by one of our Panel members, that the relationship between the Egyptian national rice researchers and IRRI has been long and productive. There would seem little to be gained by disturbing that relationship.

The third issue concerning IRRI's role in the CGIAR System on which we comment is the issue of 'ecoregional responsibilities'. This is a term that has been coined by TAC in its consideration of the future strategies and structure of the CGIAR System. TAC foresees a system that would include two main types of activities: centres with global commodity and subject matter/discipline activities, and centres with ecoregional activities. The latter would play major roles in research on the management of natural resources, on production systems development, and on socio-economics, public policy, and public management, in one or more ecoregions. In addition, centres with ecoregional activities would play major roles in strengthening national agricultural research systems in their regions to obtain the full benefits of the CGIAR System of centres. There is no existing model of a comprehensive ecoregional approach or programme, although various centres go some way toward serving some of the functions envisaged.

TAC expects that in preparing their next Medium Term Plans for the period 1994-98, each centre will consider to what extent it might propose to modify its mission, strategy, and programme to incorporate ecoregional approaches.

IRRI is clearly, in TAC's terms, a Centre with a global commodity mandate for rice, and there is no question that it has a major mission and research agenda in pursuit of that mandate. The question before IRRI is to what extent it wishes to propose to move toward ecoregional responsibilities for the warm humid and sub-humid tropics and sub-tropics, where no CGIAR centre at present has anything approaching a comprehensive ecoregional programme. The gap is partially covered by IRRI's programmes of research on rice-based ecosystems, but IRRI does not cover the rainfed areas where rice is not a major crop. While the Panel has been at IRRI completing its work and writing its report, a task force of IRRI staff members has started work on IRRI's Medium Term Plan for 1994-98. They have not reached any conclusions, nor has the senior management or Board of IRRI yet considered the issue. There is thus no IRRI proposal as yet for the Panel to react to.

Since it has been our responsibility to think hard about IRRI's future, however, we believe it is appropriate to offer a few comments.

The first is that, as we have noted, IRRI is still in a process of major transformation and rejuvenation, which is stretching - perhaps over-stretching - its management and staff. IRRI has an enormous work programme ahead, much of it in new and untried territory, and it will be several years before it can hope to be fully in command of the new programme objectives to which it has committed itself.

Second, IRRI has in fact already committed itself to major ecoregional work. Its approach to ecosystems approach requires IRRI to address resource management issues of large dimensions. Rice is by far the largest crop in several of the agro-ecological zones in Asia, so that in doing research on rice-based ecosystems, IRRI will necessarily be leading the way in learning and applying - and inventing - many of the relevant methodologies for doing research on ecoregions.

These comments could be read as recommending that IRRI should avoid assuming ecoregional responsibilities. We do not so intend them. We mean instead to emphasize that IRRI has already assumed major ecoregional responsibilities, and it should in our view be in no hurry to assume more. That is, it should continue to be an ecosystem-oriented commodity centre. By doing so, IRRI will in fact be contributing in a major way to ecoregional research, will be learning what it can and cannot most usefully accomplish, and will be contributing to the development of the necessary paradigms and methodologies for doing resource management research.

Moreover, in its ecosystems work, IRRI will be collaborating with national systems, and with other CGIAR centres. IRRI is already well launched on a cooperative research effort with CIMMYT and several national systems on rice-wheat rotations in Asia. Moreover, because of its work on upland rice-based ecosystems, IRRI is joining as a member of the international effort, coordinated by ICRAF, to find alternatives to shifting cultivation. IRRI's new ecosystem-based research consortia, establishing partnership arrangements with national systems (and potentially other CGIAR centres) to address commonly-agreed research agendas, could evolve in time into important joint instruments for assessing research progress and setting new research targets.

Thus in pursuing its new strategy, IRRI is in fact evolving in the direction of becoming a Centre with both global commodity responsibilities and ecoregional responsibilities for rice-based ecosystems in Asia. In the Panel's view, this evolution is highly desirable. It should be recognized by TAC and the CGIAR, and supported by appropriate budgetary allocations. But it would be a mistake, in our judgement, for IRRI to make a premature commitment to a broader ecoregional role or to try to foresee in detail today what can only become plain after a few years of experience.

ACKNOWLEDGEMENTS

The members of the External Review Panel wish to express their deep appreciation to the Board, management and staff of IRRI for their full, frank and open cooperation throughout the Review. The arrangements made for our visits to the Headquarters and national programmes were excellent, and we were treated as friends everywhere we went. The background documents prepared for the Review by IRRI were wholly satisfactory.

Dr. Klaus Lampe, Director General, Dr. Michael Goon, Deputy Director General, Finance and Administration, and Dr. Kwanchai Gomez, Head, Liaison, Coordination and Planning, fully cooperated with the TAC and the CGIAR Secretariats throughout the Review, from its planning stages through to the completion of this report. They deserve our special thanks for ensuring that our work could be done under optimal conditions at all times.

We are grateful to Ms. Ann Drummond, of the TAC Secretariat, and Ms. Ceres M. Pasamba, Assistant Manager, Administration, for their excellent work in supervising the typing and preparation of this report. They were most ably assisted in their tasks by Ms. Maridel O. Dolores, Ms. Yolanda Mendoza, Ms. Leonisie L. Cartina, Ms. Diadema G. Bonilla, Ms. Marissa Toyhacao, Ms. Benita M. Pangan, Ms. Rosemarie Velasquez, Mr. Alfredo E. Bacorro, Mr. Elmer Salazar and Mr. Antonio Capacete. We thank Mr. Marco Van den Berg, Mr. Nester Fabellar and Mr. George Patena for making sure that all our desk computers remained in satisfactory working order throughout.

FOURTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW OF IRRI

PANEL COMPOSITION AND BIOGRAPHICAL INFORMATION

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Name: David E. Bell (USA)

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Education: B.A., Pomona College (1939); M.A. Economics, Harvard University (1941).

Expertise: Economics, Population Sciences, Management.

Experience: 1945-1947: US Budget Bureau; 1947-1951: US White House Office; 1951-1953: Administrative Assistant to President Truman; 1954-57: Field Supervisor, Harvard Advisory Group to Planning Board, Government of Pakistan; 1957-1961: Lecturer in Economics, Harvard Graduate School of Arts and Sciences; 1961-62: Director, US Budget Bureau; 1962-66: Administrator, USAID; 1966-81: Vice President (International Activities), Ford Foundation; Since 1981: Professor of Population Sciences and International Health, Harvard University, Emeritus since 1988.

Name: Inder Pal Abrol (India)

Position: Deputy Director General (Soils Agronomy, Agroforestry), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.

Education: B.Sc. Chemistry and Biology, Punjab University (1957); Ph.D. Soil Science, Indian Agricultural Research Institute, New Delhi (1962).

Expertise: (Resource Management, Crop, Soil and Water Management, Agroforestry).

Experience: 1962-63: Post-doctoral Fellow, Faculty of Agriculture, Hebrew University, Rehovot, Israel; 1963-69: Soil Physicist/Associate Professor, Punjab Agricultural University, Hissar; 1969-82: Head, Division of Soils and Agronomy, Central Soil Salinity Research Institute, Karnal, Haryana; 1982-86: Director, Central Soil Salinity Research Institute, Karnal; Since 1986: present position. Chairman Sub-Commission on Salt-Affected Soils, International Society of Soil Science (1982-86). Chairman, Soil Technology Commission, International Society of Soil Science (1986-90). President, Indian Society of Soil Science (1990-92). Recipient of several national and international awards for outstanding research contributions.

Name: Chukichi Kaneda (Japan)

Position: Professor, Faculty of Agriculture, Kobe University, Japan.

Education: B.S., (1955), Ph.D. (1983), University of Tokyo.

Expertise: Rice Breeding, Forage Breeding and Tropical Agriculture.

Experience: 1955-63: Researcher, Forage Breeding; 1963-68: Researcher, Rice Breeding, Hokuriku Agricultural Experiment Station; 1968-72: Visiting Assistant Scientist, IRRI; 1972-73: Senior Researcher, Tropical Agricultural Research Centre (TARC); 1973-82: Chief, Rice Breeding Method Laboratory, Central Agriculture Experiment Station; 1982-85: Research Counsellor, Research Council Secretariat, Ministry of Agriculture, Forestry and Fisheries; 1985-86: Head, Dept. Summer Crop Sciences, National Agric. Res. Centre (NARC); 1986-88: Research Coordinator General (NARC); 1988-89: Director General, Tropical Agriculture Research Centre (TARC); 1989-91: Director General, NARC; Since 1991: Present position. Member of the CIAT Board of Trustees.

Name: Lowell S. Hardin (USA)

Position: Professor Emeritus and Assistant Director of International Programmes, Purdue University, West Lafayette, Indiana.

Education: B.S. Agriculture, Purdue University (1939); Ph.D. Agricultural Economics, Cornell University (1943).

Expertise: International Research Management and Agricultural Economics.

Experience: Reared on general livestock farm; 1939: Managing Editor, 'Purdue Exponent', daily student publication; 1939-43: Assistant, Cornell University; 1943-44: Assistant Director, National Agricultural Work Simplification Project and Instructor, Purdue University, 1944-49: Assistant, Associate Professor, 1950-53: Professor, 1953-65: Head of Department of Agricultural Economics, Purdue University; 1965-81: Senior Agriculturalist, Office of Vice-President, International Division, Ford Foundation. Has been closely associated with the CGIAR System for over 25 years. Served as a founding trustee of CIMMYT, CIAT, IFPRI, ICARDA, ISNAR and Winrock International Institute for Agriculture. Chairman of External Management Reviews of ILCA (1986), IRRI (1987) and CIP (1989), and Resource Person to IFPRI Review Panel (1990).

Name: Robert W. Willey (UK)

Position: Professorial Fellow, Overseas Development Group, University of East Anglia, Norwich. Special Professor in Agronomy, University of Nottingham.

Education: B.Sc. Agriculture, University of Nottingham (1960); Ph.D., University of Leeds (1965); D.Sc., University of Nottingham (1991).

Expertise: Agronomy, Cropping Systems.

Experience: University positions: 1960-64: University of Leeds; 1965-69 and 1973-76: University of Reading; 1969-73: Makerere University, Uganda; 1982-83: Cornell University (Sabbatical); 1984-90: University of East Anglia (Professor of Development Studies - Natural Resources). Research positions: 1976-84: Principal Agronomist, ICRISAT. Developing country experience in Africa, Asia and Latin America. Since 1988: Coordinator on ODA-funded Eastern India Rainfed Farming Project.

Name: Shi-Mai Zeng (China)

Position: Professor and Chair, Department of Plant Protection, Beijing Agricultural University, Beijing, China.

Education: B.Sc., Agricultural College, Beijing University (1948).

Expertise: Plant Protection, Plant Epidemiology, Disease Resistance.

Experience: 1948-53: Assistant Lecturer, 1953-60: Lecturer, 1960-80: Associate Professor, 1980-87: Professor and Head, Department of Plant Protection, Beijing Agricultural University; 1987-90: Director, Research Institute of Pest Management, BAU; Since 1990: Present position. Vice-President of Chinese Society of Plant Protection, and Member of Epidemiology Committee of the International Society of Plant Pathology (since 1983). Author of ten books and over sixty publications on plant diseases.

Name: Julie A.C. Virgo (Australia)

Position: Executive Vice-President, The Carroll Group, Inc. (management consultants).

Education: M.A. Library and Information Science (1968), Ph.D. Sociology of Science (1972), M.B.A., Executive Programme, University of Chicago (1983).

Expertise: General Management, Information Management, Organizational Behaviour.

Experience: 1961-66: Director of Libraries, Repatriation General Hospital, Adelaide, South Australia; 1968-72: Assistant Director, Health Sciences Librarianship Training Programme, University of Chicago; 1968-90: Senior Lecturer in Financial and Cost Accounting, Graduate Library School, University of Chicago; 1972-77: Director of Education, Medical Library Association, Chicago; 1977-84: Executive Director and CEO, Association of College and Research Libraries, Chicago; 1986-90: Visiting Professor in Financial and Cost accounting at the University of Michigan and the John F. Kennedy School of Management, Orinda, California; Since 1984: Executive Vice-President, The Carroll Group, Inc., Michigan. Member of the Board of Directors of eight national and international organizations, including IBPGR and ICARDA. Consultant to the U.S. Government for A.I.D., the Department of Education, National Science Foundation, National Centre for Educational Statistics, National Commission on Libraries and Information Science and National Endowment for the Humanities. Member of Third External Review of ILCA (1992).

Name: Ammar Siamwalla (Thailand)

Position: President, Thailand Development Research Institute, Bangkok.

Education: B.Sc. Econ. (Hons.), University of London (1962); Ph.D., Graduate School of Arts & Sciences, Harvard University (1967).

Expertise: Economics.

Experience: 1966-67: Assistant Professor and Research Economist, Economic Growth Centre, Yale University; 1967-68: Visiting Expert, National Economics Development Board, Bangkok, Thailand; 1971-72: Rockefeller Foundation Visiting Professor, Faculty of Economics, Thammasat University; 1972-78: Lecturer, Thammasat University, Bangkok; 1978-84: Research Fellow, International Food Policy Research Institute; 1984-90: Programme Director, Agriculture and Rural Development, Thailand Development Research Institute. Since 1990: Present position. Member, Economic Advisory Council to the Prime Minister (1974). Chairman, Sub-committee on Rice Policy, Economics Advisory Council to the Prime Minister (1974). Member, Economics Section, National Research Council (1975-78). Member, Pollwatch Committee (1992). Member, International Policy Council on Agriculture and Trade (1985 to present).

TERMS OF REFERENCE FOR EXTERNAL REVIEWS
OF CGIAR CENTRES

BACKGROUND

The Consultative Group on International Agricultural Research (CGIAR) has charged its Technical Advisory Committee (TAC) with the responsibility of conducting External Programme Reviews (EPRs) of those International Agricultural Research Centres (Centres) that it supports financially. The CGIAR has assigned a similar responsibility to its Secretariat for External Management Reviews (EMRs).

TAC and the CGIAR Secretariat normally discharge these responsibilities by commissioning either separate panels or a joint panel to conduct the reviews. In commissioning panels, neither TAC nor the CGIAR Secretariat delegates its responsibility for reviews, but both use panels to facilitate the process. Panels submit their reports for consideration by TAC and the CGIAR Secretariat before they are transmitted to the CGIAR. While the main recommendations made by panels are normally endorsed both by TAC and the CGIAR, such endorsement cannot be presumed by either the panels or the Centre under review. Equally, as autonomous institutions, Centres are not obliged to implement the endorsed recommendations. In practice, however, they usually implement most, if not all of them.

PURPOSE

Through its support of International Centres, the CGIAR aims to contribute to increasing sustainable crop, livestock, fish and tree production in developing countries in ways that improve the nutritional level and general economic well-being of low-income people. The purpose of external reviews is to help to ensure that the Centres continue to implement strategies and programmes that are relevant to these goals; that they maintain or enhance their record of achievement; and that they are efficiently managed. In these ways, external reviews reinforce mechanisms of accountability within the System.

EPRs and EMRs are also essential components of the CGIAR's integrated planning process. The context in which they are undertaken is to be found in the document 'Review Processes in the CGIAR'.

THE REVIEW

Against this background, the panel is requested to make a thorough and independent appraisal of the Centre and all its activities, following the broad topics

below, as well as the appended list of questions and guidelines. Panels are encouraged to set their findings in the broader context of the CGIAR System, where this is relevant to the activity or programme under review.

A. Recent Evolution of the Centre

Important changes affecting the Centre since the previous external review.

B. Mandate

The continuing appropriateness of the Centre's mandate in relation to the mission and goals of the CGIAR.

C. Strategy and Programmes

The policies and strategies of the Centre, their coherence with CGIAR strategies, and the mechanisms used for monitoring and revising them.

The extent to which the Centre's strategy is reflected in its current programmes; the rationale for any proposed changes by the Centre and their implications for future activities.

The quality of current programmes and activities.

D. Centre Guidance, Values and Culture

The overall effectiveness of the Centre's Board of Trustees in governing the Centre, and the effectiveness of leadership throughout the Centre.

The Centre's guiding values and culture, and their influence on the Centre's performance.

E. Programme Organization and Management

The mechanisms in place at the Centre to ensure the excellence of the programmes and cost-effective use of resources.

The adequacy of the Centre's organizational structure, and the mechanisms it uses to manage and coordinate its research programmes and related activities.

F. Resources and Facilities, and their Management

The financial resources available to the Centre in relation to its present and future programmes.

The land, laboratories and services available for supporting the programmes.

The Centre's human resources.

The Centre's information resources and facilities.

G. External Relationships

The Centre's relationships with national research systems ¹ in developing countries.

Collaboration with advanced institutions in research and training, in both the public and private sectors.

Collaboration with other CGIAR Centres and international agricultural research institutions, and undesirable overlap of activities.

The Centre's relationships with the government of its host country or countries and with institutions therein.

H. Achievements and Impact

The Centre's overall impact, its contribution to the achievement of the mission and goals of the CGIAR, and the methods used for making such assessments.

Recent achievements of the Centre in research and other activities.

The potential of the Centre's current and planned activities for future impact.

THE REPORT AND RECOMMENDATIONS

Panels are requested to prepare succinct reports in plain language (understandable to non-technical readers), in which factual material is kept to the minimum necessary to set the conclusions in context. Reports should include clear endorsements of the Centre's activities where appropriate, as well as recommendations and suggestions for changes.

Recommendations should be justified by the analysis and approved by panel members. Recommendations for increases in staff or activities should be accompanied by analyses of their resource implications. Reports should be formally

¹ National research systems include all those institutions in the public and private sectors, including universities, that are potentially capable of contributing to research related to the development of agriculture, forestry and fisheries.

transmitted to the Chairman of TAC and the Executive Secretary of the CGIAR by panel Chairs.

LIST OF QUESTIONS FOR EXTERNAL REVIEWS

These questions supplement the Terms of Reference and illustrate the types of question the panel should consider in each category. They apply to most, but not necessarily to all CGIAR Centres. In addition, TAC and the CGIAR Secretariat usually compile a short list of questions that are specific to the Centre under review. In preparation for each review, the questions are circulated to the members of the CGIAR and the Centre inviting them to comment and, if considered essential, to add supplementary questions. The panel is not required to answer all questions explicitly, but to take them into account in making its own assessment of the most important ones.

A. Recent Evolution of the Centre

1. What important changes have taken place in the Centre since the previous external review? What were the principal reasons for change? What are the likely effects of these changes on the future performance of the Centre?
2. How responsive was the Centre to the previous review?

B. Mandate

3. How appropriate are the Centre's operational mandate and mission statement in relation to the changing mission and goals of the CGIAR?
4. How well do the present and planned activities of the Centre relate to the mandate and the mission of the Centre?

C. Strategy and Programmes

5. Does the Centre have an up-to-date and well-reasoned strategy statement? In particular, does it:
 - (a) reflect a thorough understanding of the needs of the Centre's principal clients and of the relevant activities of its partners and collaborators?
 - (b) take into account the major changes expected to occur in the Centre's external environment?

- (c) spell out the Centre's aims and objectives in different programme areas and provide a clear justification for them?
 - (d) take into account the Centre's internal strengths and weaknesses and the financial constraints likely to be faced?
 - (e) provide a clear justification for the future scale of the Centre's operations?
6. Are national authorities satisfied with the Centre's strategy and did they have adequate opportunity to contribute to its formulation?
 7. Does the Centre's allocation of resources to its programmes reflect the priorities appropriately? Are the planned directions and priorities within programmes appropriate?
 8. Does the Centre's strategy sufficiently take into account the determinants of sustainable production, the alleviation of poverty and preservation of the quality of the environment?
 9. Has the Centre analyzed the operational implications of its future strategy and priorities in terms of finance, staff and other aspects?
 10. How well is the Centre's current strategy reflected in its programmes and activities?
 11. How successful has the Centre been in reaching its major objectives in each major programme area since the previous external review? Have the approaches adopted been the most appropriate for the problems to be solved? What has been the quality of the Centre's work in each programme area?
 12. How effectively does the Centre's training programme meet the needs of national research systems?
 13. How much attention has the Centre paid to gender considerations in planning and implementing its programme activities? Is this adequate?
 14. Does the Centre give appropriate attention to post-harvest technology?
 15. Has the Centre made adequate provisions from its core funds for work on genetic resources? How effectively is this work exploited for the benefit of developing countries?

D. Centre Guidance, Values and Culture

16. Is the Centre's legal status appropriate for fulfilling its mission?
17. How effective has the Centre's board been in determining policy and providing oversight? How effective has it been in managing its internal affairs (e.g., planning, internal board structure, member selection and development, managing meetings, etc.)?
18. Are board-management relationships based on openness, respect for each other's roles, and mutual trust? Does the board regularly assess and provide feedback on the performance of the director general on the basis of explicit and objective criteria?
19. How effectively has the Centre been led by the director general and the management team since the previous external review? How well do senior managers work as a team?
20. What principal guiding philosophies appear to shape the action of the board, management and staff? Are they conducive to high performance? (Among others, consider attitudes towards creativity, accountability, efficiency, and organizational change.)
21. What are the main features of the Centre's current organizational culture? Do aspects of this culture serve as barriers to performance? Is the Centre's organizational culture in harmony with its strategy, structure and management practices?

E. Programme Organization and Management

22. Has the Centre developed an organizational structure suited to good programme performance? What coordination mechanisms are in place? Are they effective? Are there alternative structures that could serve the Centre better in the future in the light of the Centre's strategy?
23. How effectively are the Centre's decentralized activities linked with those at the headquarters? Do the staff outside the headquarters have adequate opportunities to contribute to overall planning and decision making?
24. How effective are the Centre's strategic and operational (i.e. medium term and annual) planning processes? How well are they linked to budgeting? Do these processes ensure sufficient consideration of the views of the Centre's clients and other key stakeholders?

25. Does the Centre have an effective planning and management system for projects or activities?
26. How effective are the Centre's programme monitoring and internal review systems and processes? Does the Centre have an effective peer review or a similar quality control process?
27. Do staff work effectively in teams? Do the structure and operating procedures of work-groups facilitate cooperation and teamwork?
28. Do the Centre's programme organization and management processes ensure efficiency and internal accountability? Are they conducive to innovation?

F. Resources and Facilities

29. How effective has the Centre been in organizing, staffing and managing its human, financial, administrative and information resources?

Human Resources

30. Has the Centre been able to attract and retain international and local staff of the highest calibre? Is the turnover rate one that ensures programme continuity as well as healthy infusion of new staff into programmes?
31. Does the Centre have appropriate personnel policies for international and local staff stationed at the headquarters and outside it? Are they seen to be fair and consistent? (Consider policies for staff recruitment, orientation, compensation, performance planning and assessment, career development, tenure, spouse employment, retirement, etc.)
32. Does the Centre actively promote recruitment, retention and career development of women? Are there barriers to women's advancement in the Centre?
33. How successful are managers and supervisors in managing people? In particular, how skilful are they in planning, coordinating and delegating work, communicating effectively, and motivating, developing and rewarding staff?
34. How satisfied are staff at all levels with their jobs? How are morale, trust, communication and teamwork perceived among the staff?

Finance

35. How successful has the Centre been in securing funds for its activities? How stable is the Centre's funding? Does the Centre have a fund-raising strategy, and how effectively is fund-raising managed?
36. Does the proportion of the Centre's budget received as restricted funding distort the Centre's strategy and the priorities accorded to its various activities?
37. How effective are the systems and processes used for financial management of headquarters and field operations? (Consider financial planning, analysis, reporting and control, accounting, budgeting, internal and external auditing, and cash and currency management.)
38. How strongly is financial management linked with programme management? How much financial responsibility do the programme staff have?

Administration

39. How successful has the Centre been in establishing an administrative infrastructure that meets the needs of staff in an efficient manner?
40. How cost-effective are the systems and policies used for managing the Centre's:
 - property (e.g., maintenance, development, construction, rental);
 - general services (e.g., security, housing and dormitories, food services, transport, travel services);
 - procurement operations (e.g., foreign and local purchasing, receiving, stores)?

Information

41. How successful is the Centre in acquiring, generating and managing the information it needs for decision-making, communication and integration of activities?
42. How effectively are information services and technology managed? (Consider computerization, telecommunications, records management, archives, library, and documentation.)

G. External Relationships

43. How successful has the Centre been in managing its relations with:
- clients in developing countries;
 - institutions in the host country of its headquarters and of its substations in other countries;
 - public and private sector institutions in developed and developing countries (including other CGIAR centres);
 - donors, the CGIAR and TAC;
 - the media and the general public?
44. Is the Centre's strategy for collaboration with national research systems appropriate considering the sizes and stages of development of these systems? Are the priorities for collaborative work accorded to individual countries (in particular, the host country) appropriate? Does the Centre actively promote a strategy of collaboration in international research with national systems and regional research organizations?

H. Achievements and Impact

45. What mechanisms does the Centre have in place to monitor its achievements and impact? Are these adequate?
46. How does the need to demonstrate impact influence the Centre's priorities and strategies? Is there a tendency for long-term consideration to be sacrificed for short-term gains?
47. What have been the most notable achievements of the Centre since the previous external review?
48. What benefits have developing countries derived from the Centre's work since the previous review? What contributions has the Centre made to strengthening national research systems through training, institution building, collaborative research and technical assistance?
49. What is the Centre's potential for further impact, given its planned activities? Do these justify continued donor support for the Centre? Is there a case for increasing the Centre's funding level? Could funding be reduced without seriously affecting the Centre's potential for further impact?

I. List of Supplementary Questions

1. Should IRRI separate its operations into a regional research network and a global research operation? How should IRRI in the future integrate ecoregional responsibilities with its global commodity mandate?
2. IRRI has established the consortium approach to enhance research collaboration. What is the effectiveness of the approach?

LIST OF INSTITUTIONS VISITED AND PERSONS MET OR CONTACTED

1. AUSTRALIA (24-31 August 1992)

ACIAR

Dr. George Rothschild, Director

Dr. Eric Craswell, Research Programme Coordinator

CSIRO

Dr. Lloyd T. Evans, Chief Research Scientist

Department of Agriculture, Western Australia

Dr. Norman Halse, Retired Director General

2. CHINA (29 April - 3 May 1992; 21-28 August 1992)

Chinese National Rice Research Institute

Mr. Yihua Zhang, Former Deputy Director

Ms. Ying Shen, Senior Researcher

Zhejiang Province Academy of Agricultural Sciences

Mr. Suyuan Sun, Former Director

Fukien Agricultural College

Mr. Lianhui Xie, Director, Plant Protection Department

Hunan Agricultural College

Mr. Kuan Luo, Professor

Beijing Agricultural University

Dr. Yuliang Peng, Associate Professor

3. COLOMBIA (29 April 1992)

CIAT

Dr. Martinez, Acting Head, Rice Programme

Dr. Cuevas, INGER Coordinator

Dr. Sanin, Economist

Dr. Correa, Plant Pathologist

Dr. Lentini, Plant Breeder

4. EGYPT (25-28 July 1992)

Agricultural Research Centre, Ministry of Agriculture

Dr. A. Beltagy, Director General

Dr. M. Gomaas, Deputy Director General

Dr. M. S. Balal, Director, Rice Research & Development Programme

Rice Research and Training Centre, Sakha

Dr. F. N. Mahrous, Director

Dr. M. A. Maximos, Senior Breeder

Dr. A. A. El-Hisseway, Plant Breeder

Dr. I. R. Aidy, Plant Breeder

Dr. A. E. Draz, Plant Breeder

Dr. A. O. Bastawisi, Plant Breeder

Dr. A. E. El-Tantawy, Agronomist

Dr. S. Ghanem, Agronomist

Dr. A. A. El-Rahaman, Agronomist

Dr. M. A. Nour, Agronomist

Dr. R. Sehly, Plant Pathologist

Dr. Z. H. Osman, Plant Pathologist

Dr. A. M. Soliman, Plant Entomologist

Dr. S. Hassan, Weed Scientist

Mr. M. El-Chiaty, Extension Officer

Mr. A. E. El-Masry, Extension Officer

USAID, Cairo

Mr. D. Clerk, Head of Mission

Dr. W. MacCuistion, Research Adviser, National Agricultural Research
Programme

Mr. R. W. Roseguie, Project Officer

IRRI Country Project Team

Dr. Derk HilleRisLambers, Plant Breeder

Dr. A. N. Rao, Weed Scientist

5. INDIA (13-15 April 1992)

Indian Council for Agricultural Research (ICAR)

Dr. R. S. Paroda, Deputy Director General

Dr. G. S. Srivastava, Joint Secretary

Dr. O. P. Makhija, Assistant Director General

Indian Agricultural Research Institute (IARI)

Dr. S. K. Sinha, Director

Directorate of Rice Research (DRR), Hyderabad

Dr. E. A. Siddiq, Project Director

Central Rice Research Institute (CRRI), Cuttack

ICAR-IRRI Eastern India Collaborative Rice Research Programme, Kumarganj, Faizabad

Dr. P. K. Singh, Director, CRRI

Dr. S. Malik, Site Coordinator for Rainfed Lowland Rice Consortium,
Polba-Chinsurah

Dr. V. S. Chauhan, Site Coordinator for Upland Rice Consortium, Hazaribagh

IRRI-CIMMYT-ICAR-N.D. University of Agricultural Technology (NDUAT) Programme

Dr. R. K. Singh, Director of Research, and Site Coordinator for Upland Rice Consortium, Hazaribagh

Dr. O. P. Singh, Programme Leader for Deepwater Rice,
IRRI/CIMMYT/ICAR/NDUAT Collaborative Programme

IRRI-Indira Gandhi Agricultural University Collaborative Research Programme, Raipur

Dr. S. S. Bhagel, Director of Research

IRRI Liaison Office - New Delhi

Dr. B. P. Ghildyal, IRRI Liaison Scientist

6. INDONESIA (13-15 April 1992)

Agency for Agricultural Research and Development (AARD), Jakarta

Dr. Soetatwo Hadiwigeno, Director General

Dr. Djoko Budianto, Director, Centre for Agricultural Research and Programming

Directorate General of Food Crops, Jakarta

Dr. Dudung A. Adjid, Director General

Central Research Institute for Food Crops (CRIFC), Bogor

Dr. Ibrahim Manwan, Director

Dr. Mahyuddin Syam, Head, Communication and Publications

Bogor Research Institute for Food Crops (BORIF)

Dr. Edi Soenarjo, Coordinator, Rice Programme

Dr. Soetjipto Partohardjono, Coordinator, Farming Systems Programme

Dr. Sri Suharni Siwi, Coordinator, Women's Role in Rice Farming Systems

Research Institute for Food Crops (SARIF), Sukarami

Dr. Zulkifli Zaini, Director and Member of Upland Rice Consortium Steering Committee

Research Institute for Food Crops (SURIF), Sukamandi

Dr. Djoko S. Damardjati, Acting Director, Food Technologist

Dr. Bambang Suprihatno, Plant Breeder

Dr. Sunendar Kartaatmadja, Plant Pathologist

Dr. Suparyono, Plant Pathologist
Dr. Baehaki, Plant Entomologist
Ms. Hendarsih Suharto, Plant Entomologist
Mr. Hamdan Pane, Weed Scientist
Mr. Rahayu Tedjasarwana, Agronomist
Mr. Sadeli Suriapermana, Farming Systems Specialist
Dr. Udin Nugraha, Seed Technologist
Dr. Angus Setyono, Food Technologist
Dr. Eko Ananto, Agricultural Engineer
Dr. Ridwan Thahir, Agricultural Engineer

USAID, Jakarta

Mr. M. Winter, Agriculture & Rural Development Officer

IRRI Liaison Office - Jakarta

Dr. Cesar P. Mamaril, IRRI Liaison Scientist

7. IVORY COAST (6-10 August 1992)

WARDA

Dr. Eugene Terry, Director General
Dr. Peter Matlon, Director of Research

8. JAPAN (11 May 1992)

National Agricultural Research Centre, Tsukuba Science City

Dr. S. Akita, Plant Physiologist
Dr. H. Hibino, Plant Virologist
Mr. K. Maruyama, Plant Breeder

National Institute of Agrobiological Resources, Tsukuba Science City

Dr. S. Miyazaki, Head, Germplasm Management Section
Dr. H. Kaku, Plant Pathologist
Dr. Tsuchiya, Microbiologist
Dr. N. Katsura, Plant Physiologist, Director, Department of Plant Functions
Dr. M. Ishige, Biotechnologist
Dr. Y. Kurata, Cytogeneticist
Dr. K. Nakajima, Plant Breeder, Director, Department of Cell Breeding

Tropical Agriculture Research Centre, Tsukuba Science City

Dr. M. Himeda, TARC IRRI Representative
Dr. H. Murata, Director, Research Division

Ministry of Foreign Affairs

Mr. S. Adachi, Assistant Director, Multilateral Cooperation Division

9. NIGERIA (19-22 August 1992)

IITA

Dr. Krishna Alluri, INGER Coordinator for Africa

Dr. B. N. Singh, Plant Breeder, WARDA Lowland Plant Breeding Programme

10. PHILIPPINES (10-11 April 1992)

Philippine Rice Research Institute (PhilRice)

Dr. Santiano Obien, Director

Mr. Ronilo Beronio, Deputy Director for Administration

Mr. Hilario de la Cruz, Head, Plant Breeding

Mr. Eulito Bautista, Head, Agricultural Engineering

Mr. Daniel Israel, Social Science Policy Research

Dr. Teodula Metra, Soil Science Research Specialist

Mr. Justino Tepora, Consulting Scientist

Ms. Jean Recta

Mr. Florentino Olivares

Mr. Gerardo Estoy

Mr. Rodolfo Bondad, CLSU

University of the Philippines at Los Banos (UPLB)

Dr. Ruben B. Aspiras, Chancellor

Dr. Ernest M. Rigor, Vice Chancellor (Administration)

Dr. Fernando F. Sanchez, Vice Chancellor (Academic Affairs)

Dr. N. G. Mamicpic, Dean, Graduate School

National Institute of Biotechnology and Applied Microbiology (UPLB)

Dr. I. Dalmacio, Director

Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)

Dr. Cledualdo B. Perez, Executive Director

Dr. Ester Lopez, Assistant Director, Crop Research Division

Dr. Amado Magliano, Director, Farm Resources and Systems Research Division

Department of Agriculture, Quezon City

Dr. Manuel Lantin, Assistant Secretary

Dr. William D. Dar, Director, Bureau of Agricultural Research

Mr. Melcher Menguito, Crop Protection Division, Bureau of Plant Industry (BPI)

Ms. Terisita C. Silva, Agricultural Engineering Division, BPI

Mr. Corazon V. Orcullo, Agricultural Engineering Division, BPI

NGO Representatives, Manila

Ms. Nita Abergas, Agency for Community Educational Services Foundation

Ms. Belle Garcia, Congress for People's Agrarian Reform

Mr. Armando Ridao, PHILDHARA/ACES Foundation Sustainable Agriculture Coalition

Mr. Nick Perlas, Centre for Alternative Development Initiatives

Central Luzon State University (CLSU)-ICLARM-IRRI Rice-Fish Project

Professor R. Sevilleja, Director of Fresh Water Aquaculture Centre, CLSU

Dr. C. de la Cruz, Consultant, ICLARM

Dr. C. Lightfoot, Senior Scientist, ICLARM

Dr. R. Pullin, Director of Aquaculture Programme, ICLARM

IRRI-UPLB-Department of Agriculture Upland Rice Project, Santa Barbara, Pangasinan

Dr. Cesar Sevilla, Assistant Professor, Institute of Animal Science, UPLB

Mr. Jose Aquino, Research Assistant, Department of Agriculture (Region 1)

Ms. Joyce Luis, IRRI Research Assistant

Swiss Development Corporation

Dr. R. Wilhelm, Team Leader, Laos Country Project Review

11. THAILAND (13-15 April 1992)

Department of Agriculture

Dr. Ampol Senanarong, Director General

Dr. Montri Rumakom, Deputy Director General

Dr. Somkid Disthaporn, Division of Plant Pathology and Microbiology

Dr. Damkheong Chandrapanya, Director, Farming Systems Research Institute

Dr. Chak Chakkaphak, Director, Agricultural Engineering Division

Department of Land Development, Ministry of Agriculture

Dr. Boonyaruk Suebsiri, Deputy Director General

Dr. Charoen Charoenchamratcheep, Soil Scientist

Dr. Somsri Arunin, Soil Scientist

Rice Research Institute, Bangkok

Dr. Chai Prechachat, Director

Dr. Boriboon Somrith, Plant Breeder

Dr. Prasoot Sittisuang, Assistant to the Director

Rice Research Centre, Pathum Thani

Mr. Nopporn Supapoj, Plant Breeder

Rice Research Centre, Prachin Buri

Mr. Prayote Charoendham, Director

Dr. Tawee Kupkanchanakul, Agronomist

Rice Research Centre, Phrae

Dr. Vichien Petpisit, Director

Dr. Waree Chaitep, Soil Scientist

Mr. Boonrat Jongdee, Agronomist

Upland Rice and Temperate Cereals Research Station, Samsong

Mr. Soothorn Naka, Director

Ms. Sutira Moolsri, Agronomist

Chiang Mai Farming Systems Development Office

Mr. Supachai Bangliang, Director

12. UNITED KINGDOM (1 September 1992)

Overseas Development Administration

Mr. A. Bennett, Under Secretary

Natural Resources Institute

Dr. J. Holt

Dr. D. Padgam

Ms. J. Smith

Dr. I. Grant

Dr. C. Meir

13. USA (28 May - 3 June 1992)

USAID Bureau of Science and Technology, Washington

Dr. R. Cummings, Jr., Head, Office for Agriculture

Dr. D. Dalrymple, Office for Agriculture

The Rockefeller Foundation, New York

Dr. R. Herdt, Director for Agriculture

The Ford Foundation, New York

Dr. W. Coward, Head, Rural Poverty and Resources Programme

Dr. P. Geithner, Head, Asia Regional Office

UNDP, New York

Dr. T. Rothermel, Head, Interregional and Global Programme

**SURVEY ON IRRI PROGRAMMES: ASSESSING PAST PERFORMANCE AND
FUTURE NEEDS**

1. APPROACH

In January 1992, on behalf of the Fourth IRRI External Review Panel, the Executive Secretary of TAC distributed a questionnaire to 150 individuals in various institutions in Asia (South and East), West Asia and North Africa (WANA), sub-Saharan Africa and Latin America, who had some professional links with rice research. The basis for selection of participants was the mailing list provided by IRRI.

The objective of the survey was to elicit respondents' opinions on (a) the importance to them of various programmes and activities of IRRI over the past five years (i.e. 1987-91), and (b) the expected importance of IRRI's work during the next decade (i.e. 1992-2001).

The respondents were asked to evaluate each area of IRRI's work in terms of a ranking using the following scale: 1, extremely valuable; 2, moderately valuable; 3, slightly valuable; 4, not valuable at all; 5, not known. Each programme area was evaluated in terms of research, training and information activities. The programme areas were subdivided according to activities within those areas. For the programmes and activities during the next decade, the evaluation of research was in terms of the four rice ecosystems (i.e. irrigated, rainfed lowland, upland, deepwater and tidal wetland). The respondents were also asked to evaluate the effectiveness of collaboration with IRRI, and relevance of IRRI's strategy and work plan.

In addition to the above numerical evaluation, respondents were also requested to comment on: coverage and relevance of IRRI's activities; IRRI's new organization structure, operations and programmes; IRRI's collaborative mechanisms; IRRI's major strengths and weaknesses; and IRRI's major contributions.

Although the responses were anonymous, the respondents were asked to indicate their current position, type of institution, relationship to IRRI, and period of association with IRRI. Of the 65 responses received (representing 43% return), 52 were from Asia. Of the total, about half were scientists and half administrators.

Responses by programme area for each activity type (i.e. research, training and information) for the past five years are summarized in Table 1, and for the next decade in Table 2. Responses on research by programme area for each ecosystem (i.e. irrigated, rainfed lowland, upland, deepwater and tidal wetland) for the next decade are summarized in Table 3. Responses regarding the effectiveness of IRRI's collaboration, and strategy and five-year work plan are presented in Table 4.

2. RESULTS

Based on this survey, NARS clearly regard IRRI's work with genetic resources - improvement, conservation, evaluation and dissemination - as the Centre's most valuable activity.

2.1 Numerical Evaluation

The score achieved for all IRRI's activities combined for the past five years (1987-91) was 2.2 (Table 1). Research, training and information activities were considered more or less of comparable importance with average scores of 2.1, 2.3 and 2.2 respectively. In terms of specific programmes, activities related to genetic resources and IRTP/INGER were considered the most valuable (1.7 and 1.6 respectively), and those related to water management (2.8) and farm machinery (2.8) the least valuable. Relatively lower importance was also given to activities related to ARFSN (2.4), pest ecology and biology (2.4), management of soil physical and chemical properties (2.4), impact of new technology (2.4), and constraints on rice productivity (2.5).

The scientists placed relatively less value than the administrators on IRRI's research on genetic resources (1.7 vs 1.2), water management (3.0 vs 2.5), constraints on rice productivity (2.6 vs 2.1) and ARFSN (3.4 vs 2.2). With regards to responses in training and information activities, the scientists placed a greater value on IRRI's training in agronomic and physiological characteristics (1.9 vs 2.5) and on pest ecology and biology (2.1 vs 2.6).

The combined importance given to IRRI's future (1992-2001) research activities was similar (2.0) to the value of its research activities during the past five years (2.1) (Table 2). However, IRRI's future activities in terms of training and information were rated more highly (1.8 and 1.6 respectively) than the assessed value of such activities during the past five years (2.3 and 2.2 respectively). In terms of specific programmes, research related to genetic resources conservation and dissemination, germplasm improvement and crop protection all scored 1.9, with research activities on yield potential, biotic stress resistance and IPM considered the most important (1.8). For training and information activities, biotechnology applications (1.4 and 1.3) and IPM (1.5 and 1.3) were considered the most important.

There were no contrasting differences in responses between the scientists and the administrators with regards to future training and information activities across all programme areas. However, the scientists placed a lower value on IRRI's future research in all ecosystems than the administrators (2.2 vs 1.8), particularly so for biotechnology applications (2.4 vs 1.6), tillage and soil physical properties (2.7 vs 2.1), biology and ecology of pests and beneficial organisms (2.4 vs 1.9), and systems analysis and modelling (2.4 vs 1.9).

The greatest future importance was placed on the irrigated rice ecosystem (1.7) relative to other ecosystems - with deepwater and tidal wetlands rice ecosystem judged as being the least important with a score of 2.6, and rainfed lowland rice and upland rice ecosystems with a score of 2.0 (Table 3). The relatively greater importance

of germplasm related activities and IPM was clear in all ecosystems except in the deepwater and tidal wetlands.

Amongst the four IRRI-coordinated networks, respondents who are network participants rated INGER as having the greatest future importance (1.2), ARFSN the lowest importance (2.1), and INSURF and IPMN intermediate (1.6 and 1.8). In the case of the rainfed lowland rice research consortium and the upland consortium, the former achieved a score of 1.4, and the latter 1.7 from those respondents who are consortia participants (Table 4). However, the scientists placed even greater future importance to rainfed lowland consortium than the administrators (1.0 vs 1.6), whereas the reverse was true in the case of ARFSN (3.0 vs 2.0).

The future values of the four activities involved in Country Projects were all considered to be about the same in importance (1.8 to 2.3), with an order of preference for strengthening research activities (1.8), followed by institution capacity enhancement (2.0) and human resources development (2.0), followed by strategic and long-term planning (2.3) (Table 4). However, the scientists have a relatively lower opinion about the future importance of country projects than do the administrators: 2.6 vs 1.7 for institution capacity enhancement, 2.8 vs 1.5 for human resources development, 1.9 vs 1.6 for strengthening research activities, and 2.4 vs 2.2 for strategic and long-term planning.

In the case of IRRI's strategy and five-year work plan there was high agreement (1.4) with regards to ecosystem-based programmes. IRRI's new organization structure and operations, and IRRI's interactions with NARS during its last strategic planning exercise both received a score of 2.2 (Table 4), without contrasting differences in responses between the scientists and the administrators.

2.2 Respondents' Comments

Respondents' comments provided further supplementary insights to some of the trends summarized above. A select set of comments is reproduced below to indicate the range of responses received and to note some interesting individual comments.

2.2.1 Coverage and Relevance of IRRI's Activities

- IRRI should establish further collaborative research involving shuttle breeding and biotechnology (administrator, Asia).
- We basically agree with the coverage of IRRI's research and training activities. We hope that IRRI will organize workshops with extensive coverage of rice scientists to discuss rice science and exchange information (scientist, Latin America).
- IRRI should concentrate on advanced training and delegate the basic training to some national and regional programmes such as Egypt, China and India (scientist, Africa).

- We need IRRI to provide training in the field of basic research (administrator, Asia).
- IRRI's activities are impressive and dynamic with regard to their coverage and relevance to the national programmes (administrator, Asia).
- IRRI should start more training programmes at post-doc level by providing opportunities to work with a qualified and experienced scientist on new and frontier areas of technology such as biotechnology application, BNF, hybrid rice, farm machinery development, etc (administrator, Asia).
- Relatively less African scientists benefit from IRRI training compared to other continents (scientist, Africa).

2.2.2

IRRI's New Organization Structure, Operation and Programmes

- Ecosystems research will lead the various groups to isolation. More interaction of various disciplines is needed (scientist, Asia).
- IRRI's new organization structure, operation and programmes are well tuned towards the requirements of rice-producing countries and as such future rice production will be sustained to meet the needs of the ever-increasing population (administrator, Asia).
- I very much appreciate the strategy of IRRI toward 2000 (scientist, Asia).
- Completely agree. However, some of the network programmes such as INSURF, ARFSN and INGER need new orientation and direction to save them from falling into the "routine" and to minimize duplication. Although it is impossible to arrest the biological effects of aging, we should try to arrest physiological aging, to the extent possible so as to prioritize the issues and to come out with technology development which will have maximum impact with the least expenditure or by involving the least number of factors. In frontier areas of technology, such as hybrid rice, IRRI is yet to make any significant contribution, unlike in a country like China. We should also address other areas, such as biotechnology and BNF, in a more principled way, although not from the point of view of having more publications. The current trend of yield decline or yield plateauing in many irrigated rice areas in Asia as also the declining level of responses to applied inputs, unlike in the initial days of our green revolution merits our attention and detailed study (scientist, Asia).

- Their organizational structure is very good. But I do not know what division nematology belongs to - entomology or pathology division? (scientist, Asia).
- Strategy on varietal improvement is very good. However, management of rice ecosystem resources and constraints has not been spelled out (administrator, Asia).
- We believe that IRRI's rice research programmes in rainfed and upland rice ecosystems and cross-ecosystems are necessary because both are predominant in plants in Latin American and African countries (scientist, Latin America).
- IRRI should pay great attention to developing ultra high-yielding varieties with new plant types in Japonica rice and not only Indica (administrator, Asia).
- The ecosystem-based research programme would allow for an easier identification of research priorities and a straightforward relationship with national programmes (scientist, Latin America).
- I fully endorse the present ecosystem-based research programmes of IRRI since focus is now on programme rather than on discipline, which ensures interdisciplinary efforts to tackle important issues (administrator, Asia).
- Rainfed lowland rice has great potential for maximum exploitation. The area under rainfed lowland ecosystem is substantial (scientist, Africa).

2.2.3

IRRI's Collaborative Mechanisms

- While IRRI should concentrate on upstream research, it is necessary that their links to national systems also be strengthened. This is particularly true through consortia and networks (administrator, Asia).
- The tool of INGER that is integrated by national and international rice research institutions at an international level is very important because through it breeding materials which have been developed by national and international programmes can be exchanged and evaluated in a cooperative effort, and one can look at the strengthening and improving of rice production strategies. Besides INGER's assessment, the new germplasm for biotic and abiotic stresses helps agronomic characterization and grain quality in the new breeding lines, and when this process ends the best materials are included in new regional or international nurseries (scientist, Latin America).

- The collaborative programme is very effective. IRRI has played a key role in the network programmes, particularly running very effective training courses and site visit tours. This has contributed significantly to strengthening national programmes. This sort of impact of rice production technology could be seen in all Asian rice-growing countries. I have personally noticed this change in Asian countries. For example, I have developed a very strong national Azolla research programme and the major input was given by IRRI in the 1980s (scientist, Asia).
- Collaborative mechanisms have been very effective. It is suggested that these should be further strengthened and continued by contributing more scientific research, training and visits (scientist, Asia).
- Networks as presently constituted have marginal benefit. ARFSN contributed immensely in the early to late 1980s. Its focus and leadership must change (administrator, Asia).
- I think that IRRI has to have more discussion with the people involved in the country project, with the researchers, and with the farmers for understanding the real problems. I also think that some of IRRI's staff who work for a short time in a country (1, 3, 4 months) are not efficient. One of our main problems is water control, so I think that it is better and more efficient for IRRI to make more effort to help us with this matter (e.g. activities about "rainfed" must be studied more) (scientist, Africa).

2.2.4 IRRI's Major Strengths and Weaknesses

(a) Strengths:

- Free exchange of material, information, human resource development programme, leadership and above all vision (administrator, Asia).
- Unlimited facilities and a band of highly qualified scientists at the headquarters. The strong and cordial professional relationship it maintains with NARS through networks and country-oriented projects (scientist, Asia).
- Identification of appropriate germplasm for specific environments and germplasm enhancement; training; information generation and dissemination; and crop management (administrator, Africa).
- IRRI is an institution recognized for its excellence in rice research and training, and having the best infrastructure and the most experienced research scientists (administrator, Asia).

- Germplasm exchange and distribution has been very effective (scientist, Africa).
- Multidisciplinary approach to rice research and rice production, which permits greater insights into the impact of new technologies at the farm level (scientist, Africa).

(b) Weaknesses:

- Water management (scientist, Asia).
- Many young scientists at IRRI lack a thorough understanding of the rice ecosystems, major problems and constraints associated with small farmer rice-growing conditions in Asia, although they are highly qualified in their own disciplines (administrator, Asia).
- Strategy to overcome the yield ceiling has not yet been found. Weak application of biotechnology in rice improvement. Hybrid rice should be researched in quicker and effective ways (administrator, Asia).
- I do not see any major weaknesses which should be of concern at this stage. The only weakness is about its location not being representative of different rice ecosystems is now being overcome through consortia approach involving NARS sites (administrator, Asia).
- Breeding under rainfed and upland conditions, especially with regard to the latter, because it is very difficult to obtain good results in a short time (scientist, Latin America).
- No required level of research effort for improving rice productivity in rainfed ecologies (scientist, Asia).

2.2.5 IRRI's Major Contributions

- IRRI has given a great contribution in terms of germplasm development, evaluation methodologies for pests, diseases and environmental stresses (scientist, Latin America).
- IRRI's contribution through improved germplasm has helped in considerably increasing both the rice production and productivity under irrigated ecosystems (administrator, Asia).
- IRRI has contributed tremendously to research, training and transfer of technology. IRRI has helped rice-growing countries to be self-dependent in rice (scientist, Asia).

- New varieties and genetic material; research methodology in soil fertility and farming systems, short-term training of scientists personnel in methodologies. IRRN, reprint service, technical bulletins and book at cheaper costs (administrator, Asia).
- New kinds of plants. Parents for our breeding programmes. Interchange of knowledge with other countries and interactions with several other institutions (scientist, Latin America).
- Research programmes are addressing well most of the issues included in the revised strategy. Yet, intensified efforts on rainfed lowland and upland research aiming at improved productivity would be desirable (administrator, Asia).
- The major contributions IRRI has made is by providing various rice collections and testing methods. Through IRRI's collections we managed to release high-yielding varieties with good resistance to major pests such as BPH, rice blast, gall midge, bacterial leaf blight. My country is intensively and successfully putting IRRI's varieties into practice (scientists, Asia).
- Research: the flow of improved germplasm. Training and information dissemination: training on GEU, biotechnology, etc. has been valuable for our scientists working with rice; also, IRRI's publications help us to keep up-to-date with the newest information in the rice world (scientist, Latin America).

Table 1. Evaluation of Importance of IRRI's Activities, 1987-1991.

Programme Area	Research	Training	Information	Total
1. Genetic Evaluation and Utilization (GEU))	1.6 (0.11)	1.9 (0.14)	1.9 (0.14)	1.8 (0.08)
1.1 Genetic Resources	1.4 (0.09)	1.9 (0.14)	1.8 (0.12)	1.7 (0.07)
1.2 Agronomic & Physiological Characteristics	1.8 (0.13)	2.2 (0.20)	2.1 (0.15)	2.0 (0.09)
1.3 Durable Pest Resistance	1.8 (0.15)	2.1 (0.17)	1.9 (0.13)	1.9 (0.09)
2. Pest Management	2.1 (0.15)	2.5 (0.20)	2.0 (0.16)	2.2 (0.10)
2.1 Integrated Pest Management (IPM)	2.2 (0.14)	2.0 (0.13)	2.0 (0.11)	2.1 (0.08)
2.2 Pest Ecology & Biology	2.4 (0.13)	2.5 (0.16)	2.2 (0.14)	2.4 (0.08)
3. Soil and Crop Management	2.0 (0.15)	2.5 (0.17)	2.2 (0.15)	2.2 (0.09)
3.1 Soil Fertility and Management	2.0 (0.11)	2.1 (0.13)	2.1 (0.13)	2.1 (0.07)
3.2 Mgmt of Soil Physical/Chemical Properties	2.3 (0.15)	2.6 (0.20)	2.4 (0.18)	2.4 (0.10)
3.3 Rice Crop Management	2.0 (0.14)	2.2 (0.19)	2.2 (0.13)	2.1 (0.09)
3.4 Cropping Systems	2.1 (0.14)	2.1 (0.15)	2.1 (0.12)	2.1 (0.08)
4. Water Management	2.7 (0.15)	3.0 (0.17)	2.6 (0.17)	2.8 (0.09)
5. Constraints on Rice Productivity	2.4 (0.14)	2.8 (0.19)	2.4 (0.14)	2.5 (0.09)
6. Impact of New Technology	2.2 (0.15)	2.6 (0.17)	2.4 (0.13)	2.4 (0.09)
7. Networks	1.9 (0.16)	2.2 (0.21)	2.1 (0.19)	2.1 (0.11)
7.1 IRTP/INGER	1.2 (0.07)	2.0 (0.18)	1.5 (0.11)	1.6 (0.08)
7.2 INSURF	2.2 (0.15)	2.3 (0.18)	2.3 (0.16)	2.3 (0.09)
7.3 ARFSN ^{1/}	2.3 (0.21)	2.4 (0.21)	2.5 (0.23)	2.4 (0.12)
8. Farm Machinery	2.7 (0.15)	2.8 (0.16)	2.8 (0.14)	2.8 (0.09)
MEAN	2.1 (0.03)	2.3 (0.04)	2.2 (0.03)	2.2 (0.02)

^{1/}Values of ARFSN come from respondents in Asia only.

Note: Values in table are average scores over all respondents, with the standard error of the mean in ().

Table 2. Evaluation of Importance of IRRI's Activities, 1992-2001.

Programme Area	Research	Training	Information	Total
1. Genetic Resources Conservation & Dissemination	1.9 (0.07)	1.8 (0.12)	1.6 (0.11)	1.8 (0.06)
2. Germplasm Improvement	1.9 (0.09)	1.7 (0.13)	1.6 (0.13)	1.8 (0.06)
2.1 Yield Potential	1.8 (0.07)	1.8 (0.13)	1.5 (0.09)	1.7 (0.06)
2.2 Biotic Stress Resistance	1.8 (0.08)	1.6 (0.11)	1.4 (0.08)	1.7 (0.06)
2.3 Abiotic Stress Resistance	2.0 (0.08)	1.6 (0.11)	1.4 (0.09)	1.8 (0.06)
2.4 Biotechnology Applications	2.0 (0.07)	1.4 (0.09)	1.3 (0.08)	1.8 (0.06)
3. Sustainable Crop & Land Management	2.1 (0.09)	2.1 (0.15)	1.7 (0.14)	2.0 (0.07)
3.1 Crop Establishment	2.1 (0.08)	1.9 (0.12)	1.5 (0.09)	2.0 (0.06)
3.2 Nutrient Management	2.0 (0.07)	1.8 (0.11)	1.5 (0.09)	1.9 (0.06)
3.3 Problem soils management	2.2 (0.08)	1.8 (0.13)	1.4 (0.09)	2.0 (0.06)
3.4 Water Management	2.2 (0.08)	1.9 (0.12)	1.6 (0.10)	2.1 (0.06)
3.5 Tillage and Soil Physical Properties	2.4 (0.08)	2.2 (0.14)	1.7 (0.13)	2.2 (0.06)
3.6 Harvest & Post-Harvest Technologies	2.1 (0.07)	1.8 (0.11)	1.6 (0.12)	1.9 (0.06)
4. Crop Protection	1.9 (0.08)	1.7 (0.13)	1.5 (0.12)	1.8 (0.06)
4.1 IPM	1.8 (0.07)	1.5 (0.09)	1.3 (0.09)	1.7 (0.05)
4.2 Biology & Ecology of Pests & Beneficial Org	2.0 (0.07)	1.7 (0.11)	1.5 (0.09)	1.9 (0.06)
5. Constraints and Impact Analysis	2.2 (0.08)	2.0 (0.14)	1.9 (0.13)	2.1 (0.06)
6. Ecosystems Characterization	2.3 (0.08)	2.1 (0.14)	1.9 (0.13)	2.2 (0.06)
7. Systems Analysis & Modelling	2.2 (0.07)	1.7 (0.11)	1.7 (0.12)	2.0 (0.06)
Total	2.0 (0.02)	1.8 (0.03)	1.6 (0.03)	1.9 (0.01)

Note: Values in table are average scores over all respondents, with the standard error of the mean in ().

Table 3. Evaluation of Importance of IRRI's Research, by ecosystems, 1992-2001.

Programme Area	Irrigated Rice	Rainfed Lowland Rice	Upland Rice	Deepwater Tidal Wetland Rice
1. Genetic Resources Conservation & Dissemination	1.5 (0.11)	1.8 (0.14)	1.9 (0.13)	2.5 (0.19)
2. Germplasm Improvement	1.4 (0.12)	1.8 (0.17)	1.9 (0.16)	2.4 (0.21)
2.1 Yield Potential	1.3 (0.09)	1.7 (0.15)	1.8 (0.14)	2.4 (0.19)
2.2 Biotic Stress Resistance	1.3 (0.08)	1.8 (0.16)	1.9 (0.13)	2.5 (0.18)
2.3 Abiotic Stress Resistance	1.9 (0.11)	2.0 (0.17)	1.8 (0.14)	2.4 (0.18)
2.4 Biotechnology Applications	1.5 (0.10)	2.0 (0.16)	2.0 (0.13)	2.5 (0.18)
3. Sustainable Crop & Land Management	1.8 (0.13)	2.1 (0.18)	2.1 (0.17)	2.5 (0.21)
3.1 Crop Establishment	1.8 (0.12)	2.0 (0.16)	2.1 (0.15)	2.5 (0.19)
3.2 Nutrient Management	1.6 (0.09)	1.9 (0.16)	2.1 (0.14)	2.6 (0.18)
3.3 Problem soils management	2.0 (0.13)	2.1 (0.15)	2.0 (0.17)	2.7 (0.18)
3.4 Water Management	1.7 (0.11)	2.1 (0.15)	2.4 (0.17)	2.9 (0.18)
3.5 Tillage and Soil Physical Properties	2.0 (0.12)	2.2 (0.16)	2.3 (0.16)	3.0 (0.19)
3.6 Harvest & Post-Harvest Technologies	1.7 (0.11)	2.0 (0.14)	2.2 (0.14)	2.4 (0.17)
4. Crop Protection	1.5 (0.11)	1.9 (0.15)	1.8 (0.15)	2.5 (0.20)
4.1 IPM	1.4 (0.09)	1.8 (0.14)	1.8 (0.14)	2.4 (0.17)
4.2 Biology & Ecology of Pests & Beneficial Org	1.6 (0.11)	1.9 (0.14)	2.1 (0.14)	2.6 (0.17)
5. Constraints and Impact Analysis	2.0 (0.14)	2.2 (0.17)	2.2 (0.16)	2.6 (0.18)
6. Ecosystems Characterization	2.2 (0.13)	2.2 (0.16)	2.1 (0.15)	2.7 (0.19)
7. Systems Analysis & Modelling	1.9 (0.12)	2.2 (0.15)	2.3 (0.14)	2.6 (0.18)
Total	1.7 (0.03)	2.0 (0.04)	2.0 (0.03)	2.6 (0.04)

Note: Values in table are average scores over all respondents, with the standard error of the mean in ().

Table 4. Evaluation of Effectiveness of Collaboration, and of IRRI Strategy and 5-year Work Plan, 1992-2001.

	Mean Score
A. Collaborative Mechanisms	
1. Networks	
1.1 ARFSN	2.1 (0.25)
1.2 INSURF	1.6 (0.16)
1.3 INGER	1.2 (0.08)
1.4 IPMN	1.8 (0.18)
2. Consortia	
2.1 Upland Rice Research	1.7 (0.24)
2.2 Rainfed Lowland Rice Research	1.4 (0.20)
3. Country Projects	
3.1 Institutional capacity enhancement	2.0 (0.22)
3.2 Human resource development	2.0 (0.24)
3.3 Strengthening research activities	1.8 (0.16)
3.4 Strategic and long-term planning	2.3 (0.20)
B. IRRI's strategy and 5-year workplan	
1. New Organization Structure and Operation	2.2 (0.22)
2. Ecosystem-based Research Programme	1.4 (0.12)
3. IRRI's Interactions with Respondent's organization	2.2 (0.18)

Note: Values for item A are average scores over those respondents who have participated in the respective collaborative mechanism.

DOCUMENTS PROVIDED TO THE REVIEW PANEL

Documents provided by the TAC Secretariat

Review Processes in the CGIAR, 1988.

Report of the Third External Programme Review of IRRI, 1990.

A Review of CGIAR Priorities and Strategies: Parts I and II, 1992.

A Possible Expansion of the CGIAR (AGR/TAC:IAR/90/24), 1990.

Sustainable Agricultural Production: Implications for International Agricultural Research, 1989.

CGIAR Policy on Plant Genetic Resources, 1989.

Support by the CGIAR for Work on Plant Genetic Resources: Operations and Technical Issues and their Policy Implications, 1988.

The Role of Biotechnology in the CGIAR, 1989.

Documents Provided by the CGIAR Secretariat

Report of the First External Management Review of IRRI, 1987.

Overview of Management in the CGIAR Centers, 1990.

CGIAR - The Boards of Trustees of the International Agricultural Research Centers.

Roles, Relationships and Responsibilities of Trustees of International Agricultural Research Centers, 1984.

Some Thoughts Toward Ensuring the Successful Performance of Boards in the CGIAR System, 1987.

Documents Provided by IRRI

List A. Documents provided prior to the Panel's initial briefing in April 1992.

Prescription	Document
1. Most recent Annual Report of the Centre.	a) Programme Report, 1989. b) Programme Report, 1990. c) IRRI 1989: Planning for the 1990's. d) IRRI 1990-1991: A Continuing Adventure in Rice Research.
2. The latest Board approved Strategic Plan of the Centre.	IRRI Toward 2000 and Beyond.
3. The latest Medium-Term Plan of the Centre.	Implementing the Strategy: Work Plan for 1990-1994.
4. The latest Programme and Budget document of the Centre.	a) Funding Request-1991. b) Funding Request-1992. c) Financial Statements, December 31, 1990 (External Auditor's Report).
5. The current organizational Chart.	IRRI organizational structure.
6. List of the agreements with other centres and institutions on cooperative activities.	List of on-going agreements with other centres and institutions on cooperative activities.
7. List of on-going and recently completed contracted projects.	List of recently completed (1991-92) and on-going contracted projects including collaborative agreement with other centres and institutions.
8. A paper summarizing the main achievements, constraints and impact of the programmes of the Centre during the previous five years.	a) IRRI 1988-1992: Initiating and Responding to Change. b) Potential Impact of Research Achievements for the Period 1987-91. c) Summary of Achievements, Impact and Constraints of Each Programme - 1987-91. d) Impact of IRRI on Rice Science and Production.

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| 9. | Summary of actions taken in response to the last External Management and Programme Reviews. | Status report on IRRI's compliance with the 1987 External Programme Review (EPR) and External Management Review. |
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List B. Documents provided to all Panel members, at the time of the Panel's initial visit in April 1992; unless specified as:
(m) - to management specialist only
(o) - only one set of documents required

1. Staff list with summary of qualifications.
2. Table summarizing staffing patterns, with the number of staff in each category per programme and location for the current year, and an indication of the male:female ratio in each staff category.
3. A list of staff publications during the period under review.
4. Reports of major planning conferences, internal review, expert meetings, etc., which have had a major influence on the direction of the specific programmes on the Centre. (o)
5. Charter and other basic documents establishing the Centre, along with subsequent amendments.
6. A paper describing the evolution of the mandate of the Centre over the years.
7. Table showing composition of the Board over the last five years, along with an indication of the term of office of current members and their roles on the Board.
8. The Board Handbook (2 copies).
9. Set of minutes covering Board and Board committee meetings since the last External Review (and reports of Board committees to the full Board if not included in the minutes). (o)
10. Description of the internal management structure, including the composition and terms of reference of each committee.
11. Set of minutes of the meeting of the Director General's management committee covering the period since the last External Review. (o)
12. Staff manual or a description of current personnel procedures for international and locally-recruited staff.

13. Table showing allowances, benefits, and salary ranges for each category of staff. (m)
14. Local compensation surveys used by the Centre. (o)
15. Table showing personal data on internationally recruited staff by programme, including each job title, incumbent's location, period of tenure, gender, nationality, age, salary over the last three years, and source of funding. (Names to be excluded.) (m)
16. Table summarizing turnover of staff over the last five years by staff category. (m)
17. List of international staff vacancies and how long positions have been vacant. (m)
18. Reports of external auditors, including management letters, and financial officer's reports to the Board since the last External Review. (o)
19. Most recent internal audit reports to the Board. (o)
20. Internal management reports or reports written by consultants on aspects of the Centre's management that are of non-confidential nature. (m)
21. Brief description of the Centre's: (m)
 - management information systems and procedures,
 - library and documentation systems,
 - archives and records management systems,
 - computer and information technology systems and procedures.
22. Summary information on each administrative and finance unit to be prepared in the attached format. (m)
23. Documents related to Internal Audit (ref).
24. Documentation of the Staff Special Separation Programme (ref).
25. Newcomers Guide to Los Baños.
26. List of IRRI Projects:-
 - Research Matrix and Programme/Project List Work Plan.
 - International Programmes Organization Chart Work Plan, including Programme Project List.
27. Policies and Guidelines on Training (ref).
28. Master Space Plan (ref).

29. A Logical Framework for Planning Agricultural Research Programmes.
30. Report of the Third External Programme Review of the International Rice Research Institute (IRRI).
31. Report of the First External Management Review of the International Rice Research Institute (IRRI).

List C. Documents provided at the time of the Panel's main phase in September 1992. ref - 1 or 2 copies, for reference only.

1. Reports of IRRI's Peer Reviews.
 2. 1991 Corporate Report Draft (ref).
 3. 1991 Programme Report Draft (ref).
 4. Rice Statistics Database (in diskette).
 5. Documents for the Programme Report to the Board Programme Committee, September 1992.
 6. Challenges and Opportunities in a Less Favourable Ecosystem: Rainfed Lowland Rice.
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**ORIGIN AND EVOLUTION OF IRRI AND ORGANIZATION OF
RICE RESEARCH IN THE CGIAR**

Origin and Evolution of IRRI

Rice is the world's leading food crop, and the major source of livelihood for most rural people in Asia. More than three decades ago in 1959, the Ford and Rockefeller Foundations formally laid the groundwork for the International Rice Research Institute. The agreement they reached then, with the support and cooperation of the Government of the Philippines, was to conduct research on rice that would contribute to averting a looming food crisis in Asia where more than 90% of global rice production was, and still is, located. In 1960, IRRI's headquarters and research facilities were constructed at Los Baños, adjacent to the College of Agriculture, University of the Philippines, on some 80 hectares of land that was purchased by the University with funds from the Rockefeller and Ford Foundations and was made available to IRRI on a long-term lease at nominal rent.

The research during the first decade focused on raising the yield potential of irrigated rice to nearly its present levels, predominantly by changing the morphological and physiological characteristics of the rice plant. IR8, the semi-dwarf, early maturing, non-photosensitive, nitrogen responsive rice that launched the modern changes in the rice world in the mid-1960s, was followed by varieties with increased insect and disease resistance and improved grain quality, such as IR20 and IR22 in 1969. Work on upland rice began in the early 1960s as well. Accompanying the crop improvement research was a programme of institution building to develop and strengthen national rice research systems through training and information dissemination.

In 1971 the CGIAR was established, with IRRI as one of the four centres in the System. During the 1970s, IRRI's work was extended to include rainfed lowland and deepwater rice, and expanded in the areas of economics and problem soil research. Interdisciplinary work on evaluation and utilization of rice germplasm and its systematic collection, storage, distribution and testing was established during this period, as was the International Rice Testing Programme (IRTP). During the 1970s IRRI stepped up its institution building role through technical assistance and began to lay the foundation for research collaboration with the national research systems. The successes of the first decade were followed during the second decade by varieties with multiple stress resistance and improved grain quality, such as IR24 in 1971, IR32 and IR34 in 1975, IR36 in 1976 and IR42 in 1977. IR36 was broadly accepted, due in part to its resistance to nine pests and tolerance to seven adverse soils and drought, and became the world's most widely grown crop variety.

During IRRI's third decade, there was further expansion of the research programme, strengthening of national rice research systems, growing concern for women in rice farming and for integrated pest management (IPM), and movement into

biotechnology and strategic research on genetics and germplasm enhancement. In 1985, IRRI produced IR54, the first IR cultivar with highly palatable grain plus high yield potential and multiple pest resistance, followed by success with its IPM programme in several Asian countries. By the mid-1980s, IRRI had published 120 books in 34 languages and distributed them in 25 countries.

By the end of the third decade IRRI was successfully applying biotechnology to accelerate genetic studies and wide hybridization, had defined new plant types that it hoped would further raise yield potentials, developed its 'Strategy Toward 2000 and Beyond', and had trained some 6000 national programme scientists and technicians. Also, to reflect its full scope of activities, IRTIP was redesignated the International Network for Genetic Evaluation of Rice (INGER) in 1989. INGER today is the largest single pathway for distributing, exchanging and testing new rice varieties and elite breeding lines in the developing world.

At the time of the third external review in 1987, IRRI's research was organized and managed through 13 disciplinary research departments, and employed some 72 internationally recruited staff (IRS) (62 core and 10 complementary), and 2,300 nationally recruited staff (NRS) in its core and complementary programmes as of 31 December 1987. Since then, IRRI's research management has evolved to a project-based system implemented through a matrix involving five ecosystems-based programmes and eight disciplinary-based divisions. Currently, IRRI employs 81 IRS (61 core and 20 complementary) and 1,787 NRS.

IRRI enters its fourth decade as a partner in a growing community of national rice research systems especially in Asia, and facing a far more complex rice farming world (see Chapter 1). IRRI today must participate in defending productivity gains already made and in finding ways to further increase rice production in favourable as well as unfavourable rice ecosystems. At the same time it must deal with imperative concerns about sustainability and environmental protection, and the twin challenges of a stagnant yield ceiling and declining factor productivity in the favourable rice growing environments.

Organization of Rice Research in the CGIAR

Crop improvement research in rice in the CGIAR is currently shared by three Centres - IRRI, CIAT and WARDA. The relatively small rice research programme at CIAT began in 1969 when the Centre was established. The programme focuses on Central and South America and the Caribbean, with special attention to irrigated environments, and to acid upland environments. The Memorandum of Understanding between CIAT and IRRI, signed by their respective Directors General in March 1991, provides a framework for coordination of effort.

Research at IITA began in 1976 as a small component of the Cereal Improvement Programme. From the outset, the major focus of research was on varietal improvement for both upland and irrigated environments for West and Central Africa with particular reference to greater yield potential and blast resistance. Rice

improvement research at IITA terminated at the end of 1990 when responsibility for lowland rice improvement was transferred to WARDA.

In 1987, WARDA, which had been created in 1971 as an inter-governmental organization, became a full-fledged CGIAR institution to conduct research on rice improvement and rice-based farming systems in West Africa. Prior to 1987, WARDA received CGIAR funding for conducting the Regional Coordinated Trials in West Africa. The terms of the IRRI/IITA/WARDA agreement drafted in 1989 provided for the transfer of rice breeding activities from IITA to WARDA by the end of 1990, and for WARDA to assume responsibility for rice improvement in West Africa, focused on three major ecosystems: upland-inland valley continuum, Sahel irrigated, and mangrove swamp (tidal wetland). While IITA now has no rice improvement activities, it does conduct crop and resource management research in the inland valley ecosystem that represents WARDA's priority rice-growing environment, and a WARDA lowland rice-breeder is based at IITA as part of this team.

Rice research geared towards the needs of Eastern and Southern African countries, and Madagascar, and of countries in West Asia and North Africa, has been covered by IRRI initially through direct contacts and later through country projects in Egypt and Madagascar. IRRI's collaboration with IITA and WARDA is facilitated by an IRRI Liaison Scientist and INGER-Africa Coordinator based at IITA. In Latin America and the Caribbean, an IRRI Liaison scientist and INGER-Latin America Coordinator based at CIAT facilitates collaboration in germplasm exchange and evaluation.

The CGIAR endorsed the 1986 TAC recommendation that rice research in the CGIAR System should move towards more basic research because the exploitation of genetic diversity was fundamental to achieving higher and more stable yields, resistance to major pest and diseases, and better drought tolerance. Also, it would be necessary to develop new and better breeding techniques, to increase knowledge of the factors determining resistance and tolerance, and to raise yield potential by using biotechnology. TAC therefore recommended that the CGIAR System should emphasize strategic rice research (defined as mission-oriented basic research), which in turn will catalyze and support basic research in advanced institutes, and play an active role in encouraging the application of new techniques to the rice production problems of developing countries. TAC noted that almost half the global area under rice production is located in the rainfed lowland and upland rice systems, where production constraints are more complex than those of irrigated rice, and the knowledge base for research is limited. Consequently, the CGIAR emphasis has been shifting towards rainfed rice systems for reasons of equity and sustainability.

In 1991, the CGIAR allocated 20.4% of its core resources to rice research. The relative regional distribution was 61% to Asia, 19% to sub-Saharan Africa, 16% to Latin America and the Caribbean, and 3% to WANA. In the recently completed exercise on CGIAR research priorities, endorsed by the CGIAR at its May 1992 Mid-Term Meeting at Istanbul, TAC recommended a continuation of current levels of CGIAR investment in rice research, but a shift in focus towards more strategic germplasm and crop improvement research necessary to lift the yield ceiling of the crop, and to sustain current yield levels.

APPENDIX VII

ASSESSMENT OF IRRI'S PROGRESS IN IMPLEMENTING THE RECOMMENDATIONS OF THE 1987 EXTERNAL REVIEW

The 1987 External Programme Review (EPR) made 37 recommendations, and the External Management Review (EMR) made ten. IRRI's response to the 1987 Reviews has been taken into account in appropriate sections of this Report. The Panel's assessment of the Centre's response is summarized in this Appendix, in three parts: I - Research Programmes, II - International Programmes, III - Management.

Of the 37 programme recommendations, IRRI has implemented 30 recommendations in full, and ten (recommendations 1, 7, 11, 12, 14, 18, 19, 21, 29, 35) partially; IRRI did not implement two (17, 30). With respect to the ten management recommendations, seven were implemented in full, and three (3, 8, 10) partially.

I. EPR RECOMMENDATIONS -- RESEARCH PROGRAMMES

Recommendation	Implementation*	Comments
Organization 1. Organization Recommendation 35a: <i>IRRI should have a departmental organization based on major disciplines; organize its research in programmes and projects.</i> Recommendation 35c: <i>Make programmes and projects the basis of funding.</i> Recommendation 3a: <i>IRRI should continue inter-disciplinary approaches in addressing complex interactive problems of rice production systems.</i> Recommendation 3b: <i>Research should be conducted and financed through a project system.</i>	FULL FULL FULL FULL	IRRI's research was reorganized into a matrix system at the beginning of 1990, as described in IRRI's Work Plan for 1990-1994. IRRI has four ecosystem-based and one cross-ecosystems programme and eight research divisions. All research activities are based on projects developed under one of the research programmes, and the allocation of funds (core, restricted core and special project) is project-based. The programme/project structure is interdisciplinary, with project staff coming from one or more research divisions. In addition, working groups (such as the Pest Management Group, Biotechnology Group, Crop Modeling Group) hold regular meetings to discuss problems, research priorities, recent reports and techniques that cut across programme/project activities. The research consortia for rainfed lowland rice and upland rice are both interdisciplinary in approach and are planned, implemented, monitored and evaluated in partnership with national agricultural research systems (NARS).
2. Staffing Recommendation 35b. <i>Ensure that departments have sufficient senior scientists for stimulating intellectual interaction.</i>	PARTIAL	At the beginning of 1990, departments were merged into divisions to gain the desired critical mass of Internationally Recruited Staff (IRS), resulting in eight research divisions:

* Full/Partial/No

Recommendation	Implementation	Comments
		<u>Research Division</u> 1. Agric. Engineering 2. Agronomy, Plant Physiology Agroecology (APPA), 3. Entomology 4. Plant Breeding, Genetics and Biochemistry 5. Plant Pathology 6. Social Sciences 7. Soil & Water Sciences 8. Soil Microbiology Two research divisions still do not have a critical mass of IRS: the Agricultural Engineering Division (effectively one IRS) and the Soil Microbiology Division (two IRS). The plan is to merge the Soil Microbiology and Soil and Water Sciences Division in 1993. Financial constraints do not allow for any expansion at this stage.
B. Strategies for Selecting Research Priorities Recommendation 2: <i>IRRI should give more attention to the rainfed lowland environments while increasing the upstream and yield sustaining research for irrigated rice. In the less favorable deepwater and upland environments, research should continue to probe for opportunities to increase production without sacrificing long-term sustainability.</i>	FULL	IRRI has strengthened applied and strategic research within its ecosystem-based programmes. More than 16% of programme resources are allotted to the Rainfed Lowland Rice Programme. In the Irrigated Programme there is emphasis on upstream research in the form of an improved plant type to raise the yield ceiling; a key thrust in yield-sustaining research is identifying the causes and possible solutions of the yield decline occurring in intensive systems. For the less favourable environments the research objectives encompass both increased production and sustainability.

Recommendation	Implementation	Comments
Recommendation 8: <i>IRRI's present involvement in genetic engineering and biotechnology be commended and, as needs and opportunities become apparent in the future, there should be further expansion at the expense of more routine breeding activities.</i>	FULL	IRRI has increased its in-house capacity in genetic engineering and biotechnology by adding four additional IRS. The main responsibility of these staff members is tagging genes of economic importance with restriction fragment length polymorphism (RFLP) mapping. Research has been initiated to tag with RFLP markers the quantitative trait loci (QTL's) for salinity and drought tolerance, blast and bacterial blight resistance and the ability to stimulate nitrogen fixation in the rice rhizosphere. Once close linkages between RFLP markers and the QTL's are found, linked RFLP markers will be useful tools for selecting genotypes with desirable traits. One IRRI staff member shuttles between Cornell University and IRRI to ensure immediate application of new advances in this area. IRRI has regenerated plants from protoplasts of both indica and japonica rice and now has regenerated transformed plants of japonica. Collaborative linkages to work on the transformation of indica rice are being developed. IRRI expects to develop an in-house capacity for gene construct and transformation. The F₁ anther culture technique was successfully used to develop donors and promising lines with better tolerance for low temperature and salinity. The genetics and mechanism of salinity tolerance have been determined, and research on mapping salinity tolerance genes by RFLP analysis has been initiated. Studies on the genetics of P and Zn efficiency are in progress. Innovative breeding techniques, such as recurrent selection, have been found suitable for developing improved varieties tolerant of complex soil problems.
Recommendation 12: <i>IRRI should continue its work on abiotic stresses with more of an upstream approach involving soil chemistry and physics, nutrition, plant physiology and genetics.</i>	PARTIAL	With regard to soil stresses, IRRI has enhanced upstream approaches involving soil science, plant nutrition, physiology and genetics at IRRI. Collaborative research on salinity tolerance and tolerance for Fe toxicity has been established. Merging all soil stress research into one project within the Deepwater and Tidal Wetlands Rice Programme has strengthened multidisciplinary research on basic and strategic issues. However, in view of the staff shortages in the Soil and Water Sciences Division, IRRI has not fully implemented recommendation 12.

Recommendation	Implementation	Comments
Recommendation 7: <i>IRRI should acquire skills to undertake more creative research towards the goal of developing disease and insect resistance that is durable and stable. A critical and continuing need is to reduce fluctuations in productivity and profitability caused by diseases and insect pests.</i>	PARTIAL	Developing stable and durable resistance to pests is a major focus of IRRI's pest research and breeding efforts. Molecular analyses techniques are being used to analyze sources of resistance, including durable or quantitative resistance to blast and bacterial blight. Molecular markers also are being used to characterize populations of the blast fungus at Upland Rice Research Consortium key sites and to characterize populations of the bacterial blight pathogen and the brown planthopper, to ensure that pest strains used for screening reflect the diversity of natural populations. IRRI has also incorporated serological techniques, such as DAS-ELISA and ABC assay, into screening rice varieties for tungro resistance. These techniques are useful in differentiating the nature of resistance: varieties that are resistant to RTBV/RTSV infection, those that are resistant to RTBV/RTSV multiplication, and those that are tolerant of vectors. IRRI has induced mutation for breeding resistance to tungro as a method of determining the degree of resistance and susceptibility of promising lines to the disease under both field and laboratory conditions. Strains of <i>Bacillus thuringiensis</i> (Bt) that are active against two species of rice leaffolders and the yellow stemborer have been identified. Plans are to develop a transgenic rice plant that mimics the insecticidal action of the insect pathogen.
Recommendation 6: <i>IRRI should place less effort on perfecting finished varieties and give more encouragement to on-site breeding in national programmes in order to satisfy local needs, maximize genetic diversity and enable local breeders to be more successful.</i>	FULL	To encourage more on-site breeding in national programmes, IRRI sends early generation materials, primarily the F2, to national programme scientists. They grow these materials under target environments. Selections for further evaluation are made jointly. New donors and breeding lines with specific traits are provided to maximize genetic diversity in national breeding programmes. Activities in the consortia are expected to also decentralize evaluation of breeding materials and shift strategic breeding activities to key sites.

Recommendation	Implementation	Comments
D. Socioeconomics 1. Impact Analysis of New Technologies Recommendation 4: <i>IRRI should undertake on-farm component research to improve and evaluate new technologies in the environment for which they are intended. Such research involves analysis of potential socioeconomic consequences for women and children, and for the sustainability of production systems.</i> Recommendation 19: <i>IRRI should continue and expand as appropriate, analyses and programmes related to the impact of new technology on the role of women in rice production.</i>	FULL PARTIAL	IRRI has set up an international collaborative research project on rice research prioritization. Ex ante benefits and costs of new initiatives in rice research will be evaluated. On-farm component research evaluates new technologies in the environment for which they are intended. Diagnostic field surveys incorporate the perspectives of farmers, including those of women and children. The Women in Rice Farming Systems (WIRFS) sub-network involves collaborators in seven countries. They have tested and improved methodologies for specifying women's and men's role in agriculture and integrated that information into technology design, testing and assessment. To encourage the professional development of women scientists, IRRI initiated bi-annual awards for women in rice science. The first awards were made in 1990.
Recommendation 17: <i>IRRI should phase out its on-going macroeconomic analysis on the impact of rice technology in different regions of the world because, although excellent, it is now more appropriately undertaken by national and other international institutions.</i>	NO	IRRI did not accept the recommendation to phase out impact studies. They felt that study of the impact of new rice technology in different regions should continue, to keep abreast of broader implications of technological change. IRRI, in partnership with the International Food Policy Research Institute (IFPRI) and with the support of the Japanese Government, has established an international research collaboration on Medium- and Long-Term Projections and Policy Implications of Rice Supply and Demand. The Fourth External Review Panel agrees with IRRI on this issue.
2. Interdisciplinary Linkages Recommendation 16: <i>IRRI should concentrate on interdisciplinary work in socioeconomics research effort where it has a comparative advantage and which would serve the interests of</i>	FULL	IRRI's socioeconomics research looks at both biological and physical attributes of socioeconomic constraints to productivity. For example, IRRI is examining the effects of pesticide use on the health of farmers and developing methods to estimate

Recommendation	Implementation	Comments
<i>rice-producing countries: resource management to generate methodologies for analyzing the economics of pest management.</i>	FULL	the costs associated with potentially negative health effects. A monograph on the economics of pest control strategies, especially Integrated Pest Management (IPM), will be published in 1992.
Recommendation 32: <i>IRRI should consider appointing a social anthropologist to the Agricultural Economics to provide an input to any analysis of the social and economic factors influencing farming practices.</i>	FULL	To initiate the study of social and economic factors influencing farming practices, a social anthropologist was appointed to the staff of the Social Sciences Division 1 January 1990.
E. Soil, Water and Engineering Recommendation 13: <i>Since research on surface and floodwater hydrology lies outside the IRRI mandate, these activities should be phased out and the remaining soil-water-hydrology research should be integrated into the Soils Department removing the need for a Department of Water Management.</i>	FULL	The needed research on water management and its interaction with the productivity of rice-based systems in each major rice ecosystem was prioritized in the work plan. In 1990, the relevant activities of the Water Management Department were merged into the new Soil and Water Sciences Division. IRRI collaborates with the International Irrigation Management Institute (IIMI) to address the irrigation and water management problems associated with the introduction of diversified cropping options for farms in irrigation systems designed and operated for a rice - rice cropping pattern.
Recommendation 18: <i>IRRI should continue its good work on agricultural engineering to address the needs of many Asian countries.</i>	PARTIAL	Activities in agricultural engineering continue in three areas: Engineering to reduce drudgery and increase labor productivity; Engineered pest control; Post-harvest technology development. But the scale is being reduced.
F. Biological Nitrogen Fixation Recommendation 14: <i>In view of the extensive research that has been undertaken on biological nitrogen fixation by Azolla, blue-green algae</i>	PARTIAL	IRRI does not accept fully the recommendation to discontinue work on biological nitrogen fixation. It has assembled, developed and characterized an important and valuable genetic resource.

Recommendation	Implementation	Comments
<i>and other microorganisms, the work in this area should not continue beyond the completion of the existing special projects.</i>		
Recommendation 21: <i>IRRI does not require a biofertilizer germplasm centre to prevent genetic erosion nor to store the small collections.</i>	PARTIAL	A policy paper on "Biofertilizer Use in Rice Cultivation" prepared for the Board concluded that IRRI has achieved its major role of determining the potential and role of azolla and blue-green algae in Asian rice farming systems. Further research on these topics should be conducted by NARS. To meet NARS requirements, IRRI will maintain an active collection of azolla and blue-green algae. An appropriate institute to which to transfer the valuable germplasm collection for long-term conservation is being sought.
G. Pest Management Recommendation 10: <i>IRRI should strengthen its research on yield loss as affected by disease/pest intensity in relation to rice genotype and environment and give more attention to pathogen/pest microevolution in relation to development of resistance and deployment of different resistance genes.</i>	FULL	Activities in two projects address the problem of yield loss due to pests and diseases. Several activities in irrigated rice relate to the genetic analyses of resistance to key pests, quantifying field losses caused by key pests in farmers' fields and development of field methodology to quantify pest intensity - yield loss relationships. One project in the Cross-Ecosystems Research Programmes devoted to pest-yield interactions has the following activities: (1) coupling the effects of blast and other pests to rice models, (2) insect X environment interactions and their effects on yield, (3) weed effects on rice, (4) effect of stemborers, leaffolders and brown planthoppers on rice, and (5) analysis of multipest crop losses using correspondence analysis. IRRI also collaborates on two modeling projects: Systems Analysis and Simulation in Rice Production (SARP) and the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT). Pest-crop models being developed will enable environmental-neutral loss prediction and improve understanding of the mechanisms of loss. Efforts in pest population dynamics are studying pest variability in relation to deployment of specific host genes for resistance.

Recommendation	Implementation	Comments
Recommendation 11: <i>IRRI should vigorously pursue the goal of stabilizing pest populations below yield loss thresholds via all possible avenues.</i>	PARTIAL	IRRI has used IPM to guide its research on pests since 1988. Several activities are directed at understanding the basis of yield losses in the context of action thresholds, at quantifying the impact of pests on yield at different rice growth stages and at developing simple thresholds to assist decision makers in the field. Knowledge on pest population variability is being addressed at morphological, chemical and genetic levels. Other work examines pest ecology, arthropod community structure and dynamics, and the mechanism of host plant resistance to key pests. While IRRI can generate the knowledge to stabilize pest populations below loss threshold, IRRI does not and cannot implement those strategies directly. IRRI developed a close working relationship with the FAO Inter-Country Programme on Integrated Pest Control in Rice, an implementation programme that can use this knowledge. IRRI has also initiated an IPM Network to facilitate sharing of IPM technology among national programmes.
H. Farming Systems Recommendation 15: <i>The Department of Agronomy should assume responsibility for the closely related crop research currently undertaken by the Multiple Cropping Department, including agroecological and simulation modeling work. The remaining farming systems activities should only continue within the Asian Farming Systems Network, thus removing the need for a separate Department of Multiple Cropping.</i>	FULL	The Multiple Cropping Department has been merged into the Agronomy, Plant Physiology and Agroecology Division. This division, including the simulation and modeling unit, will soon be housed in a new laboratory and office complex in the LTCC building.
Recommendation 31: <i>IRRI should act as a facilitator and catalyst to help the national scientists to develop effective trials and thus gain recognition for their efforts within their own national programmes.</i>	FULL	To help national scientists develop effective trials, IRRI acts as a facilitator and catalyst by sponsoring monitoring tours, site visits and meetings/workshops. Within the Asian Rice Farming Systems Network (ARFSN), senior national scientists coordinate research in rice-animal, rice-fish and deepwater rice farming systems.

Comments	Implementation	Comments
Recommendation 30: <i>The Asian Rice Farming Systems Network should not expand further so that more time is available for interaction between IRRI staff and the national scientists to improve the quality of the programme.</i>	NO	ARFSN continues to expand.
I. Review Systems Recommendation 36: <i>IRRI should conduct regular peer reviews for each department to achieve high scientific standards and quality research.</i>	FULL	The peer reviews are guided by a list of IRRI activities that the Board of Trustees identified in 1989 as having potentials for review. A group of IRRI scientists determines the terms of reference and composition of a review team. They also summarize accomplishments of the project being reviewed. The review team itself is usually composed of three to five eminent scientists who have distinguished themselves in their fields of specialization. The team conducts the review within one week. If necessary, field visits and interactions with national scientists are arranged. Recommendations of the review panel are evaluated by a task force established to determine the applicability and feasibility of the recommendations, given the objectives of the work plan and resources of the Institute. The recommendations of the review panel and the evaluation are reported regularly to the Board. The following peer reviews have been conducted, 1990: INGER/IRGC, Women in Rice Farming Systems, Hybrid Rice, Tungro Virus, Sustainability Issues in Rice Production; and in 1991: Rice Grain Quality, Biotechnology, Training, Publications and Communication.
Recommendation 23c: <i>Encourage participation of involved national scientific leaders on a selective/rotational basis in internal programme reviews.</i>	FULL	IRRI's internal review system has been in place since 1990. Policies ensure participation of national programme scientists on each review team.

II. EPR RECOMMENDATIONS – INTERNATIONAL PROGRAMMES

Recommendation	Implementation	Comments
A. Cooperation with National Agricultural Research Systems		
Recommendation 22: <i>IRRI should develop strong collaboration between its scientists and capable partners in national programmes to help address priority problems of mutual interest.</i>	FULL	IRRI's work plan emphasizes the development of strong collaboration between IRRI and national scientists. An important one in many way is the new concept of research consortia. Two research consortia, for rainfed lowland rice and upland rice, have been established.
Recommendation 23a: <i>IRRI should facilitate the exchange of IRRI-based scientists with outreach staff and selected national scientists for periods of contractual arrangements.</i>	FULL	To facilitate scientist exchange, IRRI's visiting scientists and postdoctoral fellowship programme has been modified to accommodate more national scientists. IRRI has also posted core-funded scientists away from headquarters.
Recommendation 25: <i>IRRI should encourage those national agricultural systems with the appropriate capacity to take some responsibility, in partnership, to assist weaker national systems in building rice research.</i>	FULL	NARS have increasingly assumed responsibility in training, networks and research consortia.
Recommendation 24: <i>IRRI should continue to support national rice programmes and encourage direct donor support for the stronger national systems, thereby encouraging self-reliance.</i>	FULL	In 1991, IRRI hosted a collaborative training workshop for key decision makers from selected NARS that have advanced rice-related research and training programmes, to discuss innovative opportunities to address national and regional training needs and responsibilities. A proposal has been prepared for submission to potential donors. IRRI also trains technical content experts in training methodologies through its Training and Technology Transfer Course. IRRI has trained scientists in many of the NARS that will be involved in national and regional training activities. IRRI is increasing its efforts to develop courseware (or training materials) packages to support NARS training activities.

**THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
TECHNICAL ADVISORY COMMITTEE AND CGIAR SECRETARIAT**

**REPORT OF THE
FOURTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW
OF THE
INTERNATIONAL RICE RESEARCH INSTITUTE
(IRRI)**

**TAC SECRETARIAT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
October 1993**

Recommendation	Implementation	Comments
		In training, additional funds are needed to help implement NARS-initiated regional training programmes. Several grant proposals for donor consideration are pending. Networks coordinated at IRRI are ecosystem-based. Two have decentralized coordination of their activities. The International Network on Soil Fertility and Sustainable Rice Farming (INSURF) has been organized into subnetworks with NARS scientists as coordinators. NARS scientists are coordinators of some ARFSN activities. The rice research consortia also expand and strengthen the research base for disadvantaged rice ecosystems by utilizing existing strengths in national programmes. The rainfed lowland rice consortium has eight key sites, one each in Bangladesh, Indonesia, Thailand, and Sri Lanka and two each in India and the Philippines. The upland rice consortium has five key sites, one each in India, Indonesia, and Thailand and two in the Philippines. IRRI provides small grants from short-term projects funded by different donors to carry out some collaborative research activities with NARS. Several donors also directly support some collaborative research activities. For example, the Swedish Agency for Research Cooperation with Developing Countries (SAREC) for the Sri Lanka - IRRI Collaborative Project consists of two funding components: one for Sri Lanka and one for IRRI. We are encouraging this pattern for other collaborative projects with national programmes. On the other hand, some donors appear to prefer direct IRRI participation in the management of funds to support rice research in national programmes, possibly reflecting confidence in IRRI's ability to efficiently and effectively use, disburse and account for funds.

Recommendation	Implementation	Comments
B. International Programme Management Recommendation 37a: <i>IRRI should appoint a member of the directing staff to administer outreach programmes and to provide back-up support for outreach staff.</i>	FULL	In January 1990, IRRI established the International Programmes Management Office (IPMO) headed by an IRS who reports directly to the DDG-International programmes, to coordinate technical and administrative support from IRRI to sites away from headquarters to strengthen the feedback mechanisms from outposted scientists to headquarters.
Recommendation 37b: <i>Explore ways of ensuring that all outreach staff can visit headquarters regularly to interact with scientists and other colleagues.</i>	FULL	To ensure regular interaction among outposted and headquarters staff, an annual meeting has been held since 1988. Outposted scientists are encouraged to visit IRRI headquarters at least two times in a year.
C. Germplasm Collection and Testing Recommendation 20: <i>IRRI should continue its work on the storage of germplasm with a more selective acceptance of new material into the collection (although importance should be attached to the assembling of further collections of wild rice species), include agroeco-geographical information in the passport data of accessions whenever possible, and conduct research relating to the germplasm collection.</i>	FULL	To systematize the germplasm collection and storage, computer software has been developed to sort the databases for potential duplicates and to rationalize the collection. Newly received samples are carefully compared with the present collection; probable duplicates are compared in field plantings. Since 1987, we have added available information from files and library records on more than 10,000 accessions to the databases. A cultural type file that includes information from breeders is being developed. We have also helped develop core collections for evaluators and investigated methods for directed evaluation. A new species of <i>Oryza</i> has been described in the Botanical Journal of the Linnean Society. To date, 13 Asian countries have participated in the collection of wild relatives of rice and all known <i>Oryza</i> species have been collected. Since May 1987, 587 accessions of 22 wild rice species from 19 countries have been added to the germplasm collection and 411 incoming samples of wild rice are being evaluated.

Recommendation	Implementation	Comments
Recommendation 33a: <i>IRRI should review the IRTP with the aim of decreasing routine nursery screening of little relevance to national needs.</i>	FULL	The International Network for Genetic Evaluation of Rice (INGER), formerly IRTP, has halved the number of nursery sets available for evaluation. This involved regionalization of testing, modularization of nurseries, preliminary hot spot screening, and increased emphasis on observational nurseries. The decision to evaluate specific nurseries rest with the NARS and nursery set distribution is based on their requests. With wide agroecological diversity and variation in biotypes and races of insects and pathogens, what is of little relevance at one location may be highly relevant at another. INGER is guided by the NARS scientists represented on its advisory committee.
Recommendation 33b: <i>IRRI should review IRTP with the aim of increasing collaborative research between IRRI scientists and national scientists in projects on pathology, entomology, physiology and genetics within the IRTP framework.</i>	FULL	INGER nurseries relating to different stresses are screened by pathologists, entomologists, physiologists and soil scientists from national programmes and from IRRI. Site visits or monitoring tours organized by INGER provide an important forum for interaction and collaboration among scientists. For example, during one such visit, pathologists and entomologists from IRRI and NARS exchanged information on their experiences in improving screening and scoring procedures for diseases (such as blast) and insects (such as brown planthoppers). Collaboration is underway to characterize blast populations from key INGER upland sites in Indonesia, Bangladesh, Brazil and Colombia. Other monitoring visits led to increased collaboration on cold tolerance and salt tolerance, and to identification of areas for future collaboration on insect biotypes. Another outcome was the establishment of a regional screening trial to identify suitable "boro" rice varieties
Recommendation 33c: <i>IRRI should review the IRTP with the aim of considering whether IRTP staff posted in Latin America, the Caribbean, and East and West Africa could be appointed to the staff of CIAT and IITA, respectively, and thus be integrated fully into the rice teams of the institutes having responsibilities for rice research in those continents.</i>	FULL	INGER staff positions in East Africa and the Caribbean were terminated in July 1989. INGER programmes in Africa and Latin America are being coordinated by IRRI Liaison Scientists on the staffs of IITA and CIAT. Their activities are fully integrated in the work plans of those institutes. INGER helps to identify research needs; follow-up requires collaboration among participating scientists. The network does not fund follow-up collaborative research.

Recommendation	Implementation	Comments
D. Training Recommendation 26: <i>The training and fellowship programmes should be shaped to take into account the expansion of national educational training facilities of the national systems. To this end, greater emphasis should be given to PhD's. IRRI's training programme should move upstream, and, therefore, some programmes should be dropped and national institutions encouraged to take the responsibility for others.</i>	FULL	In 1987 there were approximately equal numbers of MS and PhD scholars. By 1991 there were more than twice as many PhD scholars as there were MS ones. IRRI is developing more specialized upstream courses dealing with the application of new knowledge in biotechnology and environmental sustainability in different rice ecosystems. Some short-term training courses have been dropped. IRRI is moving away from an emphasis on applied production courses and is developing mechanisms to decentralize these to selected NARS.
Recommendation 27: <i>Every effort should be made to maintain the highest calibre of fellows; to the extent possible encouragement should be given to those postdoctoral candidates who have thesis work in first-class universities. Fellowship selections should be made with a view to bringing fresh ideas to IRRI and sustaining vigor and dynamism of the Institute.</i>	FULL	Efforts have been made to recruit well trained postdoctoral research fellows, particularly in such fields as biotechnology, geographic information systems and global warming.
Recommendation 28: <i>IRRI should be more assertive about screening applications for its fellowship programmes; it should use its right to veto applications judiciously.</i>	FULL	The IRRI Training Policies and Guidelines, approved by the Board of Trustees in 1990, includes selection criteria. In NARS where an IRRI liaison or representative scientist is posted, applications for training programmes are initially screened before forwarding those qualified to IRRI. IRRI senior scientists with the relevant disciplinary expertise screen applications against criteria established in the policies and guidelines document. The IRRI committee on MS, PhD and nondegree scholarships makes the final determination as to the suitability of candidates against the funding available.

Recommendation	Implementation	Comments
Recommendation 29: <i>IRRI should review the burden carried by senior scientists in their capabilities as researchers and educators to ensure that they are in a position to fulfill their functions adequately.</i>	PARTIAL	Guidelines specifying that "each IRS is allowed to have no more than four MS/PhD advisers" have been adopted. Still remaining to be addressed is the reality that the resource persons (many of them IRS) often request a rescheduling of their lecture(s) (which affects the sequence of topics) or send poorly prepared last minute substitutes. IRRI is trying to address this by adding a component to the PAR form for NRS and IRS evaluation.
E. IRRI's Role Outside Asia Recommendation 34: <i>IRRI should concentrate its research and training in Asia and that it should only work elsewhere at the request of and in collaboration with CGIAR centres that have regional or continental responsibilities for rice.</i>	FULL	Except for INGER activities in Africa and Latin America and the Madagascar-IRRI and Egypt-IRRI collaborative projects, IRRI has negligible research activities outside Asia. Plans for collaborative research in upland rice were developed at a January 1991 meeting of CIAT, WARDA and IRRI scientists. A tripartite agreement among IRRI, IITA and WARDA clarifying the division of responsibilities in Africa was signed in 1991. It gives IRRI the responsibility for developing a regional rice research programme in Eastern, Central and Southern Africa (ECSA), with emphasis on irrigated and rainfed lowland rice. The ECSA region is outside WARDA's mandate. Current allocations of responsibilities are being discussed by the Inter-Centre Rice Review Panel. From 1987 to 1991, more than 80% of the degree scholars trained at IRRI were from Asia. Trainees for short-term programmes from Asia ranged from 77% to about 95%. African and Latin American nominees for training at IRRI are selected after consultation with IITA, WARDA and CIAT.

III. EMR RECOMMENDATIONS - MANAGEMENT

A. IRRI's Legal Status and Governance Recommendation 2: <i>IRRI's Board elevate management considerations to a par with programme matters.</i>	FULL	IRRI's Board of Trustees immediately created a Management Committee as a new standing committee of the Board, in addition to the Executive, Programme, Audit and Nominating committees in existence at the time.
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Recommendation	Implementation	Comments
		Membership on the Management Committee included the members of the Executive and Audit Committees. Arrangements were made for the participation of other Trustees and of adjunct consultants, as appropriate. A major result of the new Committee was to significantly increase the constructive attention given by the Board to human resources, finance and budget, and administrative issues. The major item on the agenda of the Management Committee's first meeting in August 1987 was action on External Management Review recommendations. In February 1989, the Board of Trustees combined two standing committees--Management and Executive--into one Executive Committee with five members. The rationale was that: - A major function of the Management Committee had been to respond to the recommendations of the External Management Review. By 1989, the majority of the recommendations had been implemented and the Director General had installed a monitoring system for follow-up, with regular progress reports to the Board. - It was difficult to differentiate the responsibilities of the Management and the Executive Committees and to plan independent agenda. In September 1989, the Board created the Finance and Administration Committee to address policy issues related to human resources, finance and budgets, renovation and construction, and other administrative matters. In 1990, the IRRI By-laws were revised. The statement naming the Director General an ex-officio member of the Board and of all its standing committees was rewritten to read: "The Director General shall be an ex-officio member of the Board without voting rights and of all standing committees of the Board except the Audit Committee. Since 1987, the Board has emphasized electing some trustees with professional competence in economics, management and finance. In 1988, Dr. W. P. Falcon, Director of the Food

Recommendation	Implementation	Comments
		Research Institute, Stanford University, USA, was elected a Trustee. In 1989, Dr. M. Yunus, Managing Director of Grameen Bank, Bangladesh, was elected. They are still serving on the Board: Dr. Falcon has been Chair since 1989, Dr. Yunus is currently chairing the Finance and Administration Committee. The Institute created a Liaison, Coordination and Planning Unit (LCPU) in 1990. One of its major responsibilities is to provide staff support to Board-related activities. Board procedures, including preparation of minutes and papers for discussion and approval, have been systematized. Supporting documentation is sent to Trustees 3-4 weeks before each Board meeting. The Deputy Directors General for Research and International Programmes serve as resource persons to the Board Programme Committee, the head of LCPU serves as secretary to the Nominating and the Finance and Administration Committees, and the Secretary to the Board serves as secretary to the Audit Committee. Board of Trustees relationships with IRRI staff have been strengthened by a newly-initiated review process. It includes reports to the Programme Committee of the Board at each semi-annual meeting. Staff members present reports of their work during those sessions. In addition, a staff seminar on key programme activities is held on the last day of each Board meeting, poster sessions with associated staff present to explain the issues are occasionally presented and visits of Trustees to experimental fields and laboratories are frequently organized. The practice of the Chair reporting to staff following each Board meeting has been continued.
B. Programme Planning and Review Recommendation 1: <i>IRRI consider the draft report of the Strategic Planning Committee only as initial input to the formulation of its long-term strategy.</i>	FULL	In 1988, the Institute initiated an extensive review of its planning process and focus. The result was the formulation of a long-term strategic plan that had input from a wide cross-section of concerned parties. Its development involved the following activities:

Recommendation	Implementation	Comments
Recommendation 9: <i>IRRI review its short-term planning and review processes in the light of its strategic plan and the medium-term programme and budget review mechanisms initiated at the system level.</i>	FULL	■ Establishment of the IRRI Strategic Planning Group composed of IRRI staff, with an outside professional writer as resource person. The Strategic Planning Group received guidance and advice from the Director General on a regular basis and worked closely with him throughout the process. ■ Naming of working task forces of staff to assemble specific materials and review aspects of the plan as it developed. ■ Convening of several consultation panels involving world-renowned scientists, national agricultural research scientists, collaborators and administrators, host country scientists and representatives of non-governmental organizations with whom the Institute works, to provide strong, in-depth reviews of the draft plan. ■ Periodic consultation with the Board of Trustees and the Technical Advisory Committee (TAC) of the CGIAR. The IRRI Strategy takes a long-term view and specifies clearly the Institute's clients, goals, objectives, policies and priorities, programme thrusts and modes of collaboration, with the associated rationale. The strategic plan <i>IRRI Toward 2000 and Beyond</i> was approved by IRRI Board of Trustees, TAC, and CGIAR in May 1989. On the basis of that plan, the Institute shifted toward medium-term planning. Working groups of internationally recruited staff (IRS) and nationally recruited staff (NRS) were involved. Periodic consultation with the Board of Trustees and some key national agricultural research system (NARS) partners took place. The <i>Work Plan for 1990-1994</i> was approved by TAC and the CGIAR Secretariat in October 1989. Yearly reviews of programme implementation are conducted by the Board of Trustees Programme Committee. Financial discipline is maintained through annual budget reviews with programme leaders and division/centre/unit heads and through internal and external audits.

Recommendation	Implementation	Comments
		Strategically-oriented internal programme reviews had been conducted annually. In 1990, peer reviews were initiated, to add another dimension to the validating process. The peer reviews scrutinize the status of programmes/projects, constraints, opportunities and challenges, and suggestions to further refine and improve operations. Each year, topics are identified for in-depth peer review. A task force composed of IRRI scientists develops the terms of reference for each topic. Experts representing research, education and industry, and occasionally donor agencies, constitute each Review Panel. The panels are interdisciplinary and participation by national agricultural research system scientists is ensured. IRRI has developed and is implementing a comprehensive master plan for space allocation that involves the rehabilitation of existing facilities.
C. Organizational Structure Recommendation 5: <i>IRRI devise and implement a fair and equitable scheme for staffing the organization structure that emerges from the strategic planning process.</i>	FULL	The Institute's organizational structure has been reviewed and revised, based on the new Strategy. The main features of the new organizational structure are: ■ In addition to the Director General, top management includes three Deputy Directors General—one for research, one for international programmes and one for finance and administration. Units and functions are clearly assigned to a particular DDG office. ■ A matrix management structure has been adopted for research. It aims to retain disciplinary strength, provided by the eight research divisions, and enhance multidisciplinary approaches with ecosystems focus and strategic/upstream research emphasis, through the five research programmes. ■ Support services are centralized, as illustrated by the Central Research Farm and the Analytical Service Laboratory and Pesticide Residue Laboratory. Support activities in Finance and Administration have been regrouped and streamlined.

Recommendation	Implementation	Comments
		■ Some support services (e.g., some aspects of food and housing, and security) are contracted to outside agencies. A critical evaluation of the advantages and disadvantages of contracting has been made. Those that show merit (such as security services) have been fully or partially contracted. Others have been found to be more efficiently handled in-house. ■ The organization has been made more lean. The total NRS work force has been reduced from 2,300 in December 1987 to 1,518 in December 1991. Through the Special Separation Programme and by not filling vacancies, IRRI abolished 728 positions. ■ On the IRS side, 41 IRS (core and special funding) left the Institute 1988 through 1991, 46 new IRS were hired. ■ New IRS personnel policies and guidelines were developed. The major change introduced fixed-term contracts, with clear indication that the Institute does not offer tenure.
D. Management of Research Recommendation 4: <i>IRRI consider the adoption of a project planning and management system with the aim of increasing the challenges, responsibilities and accountability of individual scientists.</i>	FULL	IRRI adapted the Logical Framework for Planning Agricultural Research Programmes, used by several development agencies, in developing its five-year work plan. The approach is outlined in Schubert et. al. (IRRI 1991). The procedure resulted in clearly defined projects and linkages. Each project has a set of activities, leading to an objective based on constraints identified for a given rice ecosystem. Scientists are assigned to specific tasks in one or more projects. The project structure for each project has clearly defined objectives, inputs and expected outputs, and a specified time frame. Project-based budgeting, accounting and reporting systems for financial planning and monitoring and for controlling expenditures were later expanded to provide budget and expenditures by individual scientists.

Recommendation	Implementation	Comments
		A project-based management system supports the matrix structure. Roles and responsibilities of project coordinators, programme leaders and division heads are clearly defined. The DDG-Research has overall responsibility for research direction and priorities, to ensure adherence to the strategy and work plan. The programme leader coordinates activities and budgets of all projects in a programme, to achieve the expected outputs outlined in the work plan. Division heads oversee staff support and scientific rigor in programme/project activities. Both programme leaders and division heads have joint responsibility for evaluating the performance of an IRS, with final evaluation done by the DDG concerned. IRRI's budget involves three major components: Personnel Services (salaries, benefits and allowances), General Operating Costs (field supplies, field labor, travel, etc.) and Capital (renovations, construction and equipment). The budgeting process is initiated at the project level. Each project coordinator determines resource requirements (human and financial) using predetermined parameters, planning figures and planning forms. Scientists allocate their time to projects in consultation with the project coordinators.
E. Human Resource Management Recommendation 3: <i>The Board and the incoming Director General give early and close attention to reforming IRRI's human resource management function.</i>	PARTIAL	The Personnel and Legal Department (PLD) has been split in two: personnel was formed into the new Human Resources Department (HRD). HRD has been effective in developing job specifications, conducting salary surveys, preparing the NRS personnel manual and, especially, planning and implementing the Special Separation Programme. While the Centre has made major improvements, some challenges still remain as they affect NRS HRD. As part of the continuing process of upgrading the effectiveness of the HRD, an external review of its mission, goals and achievement has been undertaken. Personnel management has been and continues to be particularly challenging, and management hopes to fill the current vacancy of HRD Manager soon, with a person skilled in communication, human resource development, counseling and planning.*

* Pending the final selection of an HRD manager, an interim manager has been appointed.

Recommendation	Implementation	Comments															
		The Institute undertook an extensive analysis of the compensation system applicable to NRS in 1988. An external agency conducted a job evaluation study and wrote position descriptions. Those position descriptions were refined and have been used in developing an Institute-wide staffing table. This was particularly useful as job content changed and responsibilities increased following staff reduction in 1989. Job descriptions are updated periodically. Periodic reviews of the NRS salary structure are conducted and adjustments made as appropriate. IRRI participates in a number of salary surveys to assist this process. The Institute also has developed guidelines for NRS salary administration. While IRRI is struggling to reduce personnel costs, competition in national and international private sector for skilled employees is accelerating. Since 1987, considerable effort has been made to enhance training opportunities for all IRRI staff. For economic reasons, the Institute is retraining current staff wherever possible rather than recruiting new staff, and NRS are encouraged to participate in specialized training within the Philippines and abroad. The total number of NRS participating in training and total person-days in training, for the period 1988-1991 are shown below. These retraining efforts are linked with special efforts to familiarize new staff with the Institute. <table> <tr> <th><u>Year</u></th><th><u>NRS person-days</u></th><th><u>NRS participants (number)</u></th></tr> <tr> <td>1988</td><td>372</td><td>93</td></tr> <tr> <td>1989</td><td>1306</td><td>460</td></tr> <tr> <td>1990</td><td>1901</td><td>835</td></tr> <tr> <td>1991</td><td>309</td><td>176</td></tr> </table> To help them understand their new work environment and the work of IRRI, new NRS participate in an orientation programme. Quarterly briefings given by the Deputy Directors General for Research and Finance and Administration, by Visitors Services and by the Human Resources Department cover such matters as personnel policies, employee services, and Institute facilities.	<u>Year</u>	<u>NRS person-days</u>	<u>NRS participants (number)</u>	1988	372	93	1989	1306	460	1990	1901	835	1991	309	176
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Recommendation	Implementation	Comments
		An outside consultant has been working with IRRI to develop a Performance Management System training course to assist staff in developing problem-solving, objective-setting and planning skills. Complementing this is a Performance Appraisal training programme to assist NRS in receiving and providing feedback on individual performance. Participants' reaction to these programmes was not at the level desired and alternative ways to make such training more effective are being examined. The final draft of the updated NRS Personnel Policies and Guidelines Manual was reviewed by the Board of Trustees in April 1992. Major efforts to improve the management skills of IRS also are underway. Two groups participated in CGIAR management skills courses in 1989 and 1990, and in-house course involved about 20 IRS in 1991. The feedback thus far has been positive and training of this type seems to be improving basic management expertise across the Institute. A cross-cultural sensitivity programme for IRS and spouses is being initiated. Informal familiarization with the Philippine culture, especially of new staff, will ultimately have a positive effect on staff performance. IRS have participated since 1989 in a management by objectives performance appraisal. The process has been refined each year and appears to largely meet the need to objectively assess research output and at the same time provide staff with constructive feedback. IRS compensation is monitored regularly to insure internal equity. Salary ranges also are adjusted annually.
Recommendation 10: <i>Personnel policies concerning outposted scientists be brought more closely into line with those that apply to headquarters-based staff.</i>	PARTIAL	An IRS Policies and Procedures document was prepared in 1989 and updated in 1991. This compilation of policies and entitlements has been well received. While some refinements need to be made, outposted staff indicated in September 1991 that the policy framework essentially meets their needs. Several areas related to housing

Recommendation	Implementation	Comments
		rental costs and outpost differentials are being reexamined now to determine needed changes. The IRS policy paper applies in principle to all IRS, irrespective of their contract status (core or special funding).
F. Financial Management Recommendation 6: IRRI - <i>study the implications of its heavy dependence on restricted funding (restricted core plus special projects) on future programme flexibility</i> - <i>reform the organization and staffing of the Accounting Department to enable it to carry out future responsibilities efficiently, and</i> - <i>place high priority on computerization and the formalization of financial systems and procedures.</i>	FULL	Significant economic and political changes over the last four years have influenced the CGIAR and IRRI. Dependency on special funding will continue to be a necessity. IRRI has been successful in generating special project funds for a number of research projects it judges to be of high priority. With the adoption of a project-based management system, restricted funding can be used to support projects and activities within the approved work plan. This gives the Institute better control over the balance of resources allocated among projects and increased ability to assess the implications of funding on research plans. The extraordinary costs of the Special Separation Programme (above \$2 million) and \$3.7 million of the \$15.6 million building rehabilitation programme had to come from core funds. Without special project funding, the latter programme would have been impossible. IRRI management has significantly strengthened and improved the Finance Department and the Institute's approach to financial management. Key steps included: ■ Introducing new financial control systems that provide better control of the balance of resources allocated among projects and better assessment of the implications of funding on research direction. ■ Completely reorganizing the Finance Department, with trained personnel equipped to serve the new project-based management system.

Recommendation	Implementation	Comments
		■ Bringing the Institute accounting practices into conformity with CGIAR accounting guidelines. ■ Developing comprehensive operating and procedures manuals for each section within the Finance Department. ■ Establishing a Materials Planning and Control section within Materials Management. The Property and Assets section also monitors and records inventory movement. With these in place inventory control and movement are receiving closer scrutiny. ■ Refocusing financial planning and budgeting to support the new project-based management system. ■ Strengthening Internal Audit with increased staff and upgrading of positions to reflect responsibilities. The Internal Audit Manager reports directly to the Director General and meets with the Audit Committee of the Board semi-annually. Computerization of financial management followed acquisition of a mainframe-based integrated financial and administrative software package that responds to requirements in Purchasing, Inventory Control, Accounts Payable, Payroll, General Ledger and Personnel. In addition, a project-based accounting system enables prompt submission of monthly reports on expenditures to project coordinators. Division/centre/unit heads, programme leaders and DDGs receive overall financial statements against budget figures. The Finance Department was reorganized in 1987, with the creation of four distinct sections: General Accounting, Cash Management, Budget, Financial Systems. Each Section is headed by an experienced and qualified manager, with an appropriate number of internal supervisors supported by accountants. A manual on the organization and functional responsibilities of the Finance Department produced in 1987 has been revised to include a new organizational structure and job descriptions.

Recommendation	Implementation	Comments
G. General Administration Recommendation 8: <i>IRRI help staff at all levels understand more clearly what the Institute administrative policies are and how they are implemented.</i>	PARTIAL	To improve communication to staff about IRRI's policies, an Administrative Handbook collating operating procedures by function was developed. Given its extensive coverage, a simplified employee handbook highlighting policies with cross reference to the Administrative Handbook is being developed. Staff are now better informed of IRRI policies and the standards to which they will be held. Broad dissemination of IRRI policies provides a basis for dealing more severely with instances of theft, corruption or impropriety. IRRI's efforts to retrain IRS, especially in-house, have helped enhance understanding among staff across the Institute. The recent appointment of the Director for Administration from the scientific staff is another effort to improve the Orientation of IRRI support units to their clients. Still needed are further continuing efforts to make administrative practices and policies transparent, and better understood.
H. Information Management Recommendation 7: <i>IRRI give high priority to bringing a new computer centre manager on board and, with his/her help, move with dispatch toward effective computerization of administration and research operations.</i>	FULL	The Institute filled the position of Computer Manager in 1987. Since then, Computer Services have ■ Installed a relational data-base management system (Oracle) on a new hardware platform (Digital VAX). ■ Dedicated two mainframe computers (IBM and VAX) to support the needs of research and administration. ■ Made statistical analyses packages available to research staff using personal computers.

Recommendation	Implementation	Comments
		■ Acquired state-of-the-art databases for the Library to use in retrieving non-rice information. The major application that has been transferred to the VAX/Oracle platform is the Germplasm Bank database. A complete query system was developed together with utilities for data maintenance and reporting and a comprehensive user manual has been developed. Other systems that have been developed include the Rice Virus Data Base, the Physiology Data Base, the IRRI mailing list data base and the Centralized Farm Management system. Scientists access these databases through a Local Area Network (LAN). Currently, scientists in the Laboratory, Training and Conference Centre (LTCC), Nyle C. Brady Laboratory (NCBL), Chandler Hall and Biofertilizer buildings can connect their personal computers to the LAN; plans are to have all major buildings in the Institute connected by the end of 1992. An added advantage of the LAN is that IRRI researchers can draw upon people and information resources outside IRRI by means of the Institute's connection to a Wide Area Network (WAN).

GLOSSARY OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AIDAB	Australian International Development Aid Board
APPA	Agronomy, Plant Physiology and Agroecology Division
ARBN	Asian Rice Biotechnology Network
ARFSN	Asian Rice Farming Systems Network
ASI	Advanced Scientific Institution
ASL	Analytical Service Laboratories
Bt	<i>Bacillus thuringiensis</i>
CABI	CAB International (formerly Commonwealth Agricultural Bureau Int.)
CE	cross-ecosystems
CGIAR	Consultative Group on International Agriculture Research
CIAT	Centro Internacional de Agricultura Tropical
CIDA	Canadian International Development Agency
CIEM	Council of IRRI Employees and Management
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CMS	cytoplasmic male sterility
CPS	Communication and Publications Services
CRF	Central Research Farm
DDG	Deputy Director General
DG	Director General
DNA	deoxyribonucleic acid
ECSA	Eastern, Central and Southern Africa
EDP	electronic data processing
EM	electron microscope
EMR	External Management Review
EPA	Environmental Protection Agency
EPR	External Programme Review
ESL	English as a second language
FAO	Food and Agriculture Organization of the United Nations
FHS	Food and Housing Services
GEF	Global Environmental Facility
GEU	Genetic Evaluation and Use Programme
GIS	Geographic Information Systems
GLH	green leafhopper
GMS	genic male sterility
GRC	Genetic Resource Centre
GUS	β -glucuronidase
HRD	human resources development
IARC	International Agriculture Research Centre
IBSRAM	International Board for Soil Research and Management

ICARDA	International Centre for Agricultural Research in Dry Areas
ICIPE	International Centre of Insect Physiology and Ecology
ICLARM	International Centre for Living Aquatic Resources Management
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre, Canada
IFDC	International Fertilizer Development Centre
IFPRI	International Food Policy Research Institute
IIMI	International Irrigation Management Institute
IITA	International Institute of Tropical Agriculture
INGER	International Network for Genetic Evaluation of Rice
INSURF	International Network on Soil Fertility and Sustainable Rice Farming
IPC	Institute Programme Committee
IPM	integrated pest management
IPMO	International Programme Management Office
IPMRN	Integrated Pest Management for Rice Network
IRAT	Institut de Recherches Agronomiques Tropicales et de Cultures Vivrières, France
IRGC	International Rice Germplasm Centre
IRGD	International Rice Genealogy Database
IRLON	International Rainfed Lowland Observational Nursery
IRRI	International Rice Research Institute
IRS	internationally recruited staff
IRTP	International Rice Testing Programme
ISNAR	International Service for National Agricultural Research
LAC	Latin America and the Caribbean
LAN	local area network
LCPU	Liaison, Coordination and Planning Unit
MC	Management Committee
NARS	National Agriculture Research System
NGO	non-government organization
NRI	Natural Resources Institute, U.K.
NRS	nationally recruited staff
ODA	Overseas Development Administration
OPAC	online public access catalogue
ORSTOM	Institut Français de Recherche Scientifique et Technique Outre-Mer
PGMS	photoperiod responsive genic male sterility
PPS	Physical Plant Services
PRECODEPA	Regional Cooperative Potato Program
QTL	quantitative trait loci
RAPD	randomly amplified polymorphic DNA
RFLP	restriction fragment length polymorphism
RGSV	rice grassy stunt virus
RTSV	rice tungro spherical virus
SACCAR	Southern Africa Centre for Cooperation in Agricultural Research
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SARP	Simulation and System Analysis in Rice Production
SC	Steering Committee

SDC	Swiss Development Cooperation
SSA	Sub-Saharan Africa
SSP	Special Separation Programme
TAC	Technical Advisory Committee
TGMS	temperature responsive genic male sterility
UNDP	United Nations Development Programme
UPLB	University of the Philippines at Los Baños
USAID	U.S. Agency for International Development
UV	ultra-violet rays
WANA	West Asia and North Africa
WARDA	West Africa Rice Development Association
WBPH	white backed planthopper
WIRFS	Women in Rice Farming Systems

