



**CGIAR Annual General Meeting 2001**  
**BUSINESS MEETING - Washington DC, USA, November 1, 2001**

**AGENDA ITEM: 2 – Evaluation**

**a) External Program and Management  
Review of IITA**

**Issue(s):**

The Panel Chair of the Fifth IITA External Program and Management Review will summarize the Panel's findings and recommendations. Members will be able to ask questions and raise concerns.

**Supporting Document(s):**

Report of the Fifth External Program and Management Review (EPMR) of IITA together with the Response of IITA's Board and Management to the Review Report, the TAC Commentary on the Review, and the transmittal letter from the Chair of TAC and the CGIAR Director to the Chairman of the CGIAR.

**PURPOSE OF THIS COMMUNICATION**

<input type="checkbox"/>	Information
<input type="checkbox"/>	Discussion
<input checked="" type="checkbox"/>	Decision

**OUTCOME**

<input type="checkbox"/>	No further action required
<input type="checkbox"/>	Approved/accepted
<input type="checkbox"/>	Additional information required
<input type="checkbox"/>	Referred to the next meeting
<input type="checkbox"/>	See comments below

**COMMENTS**

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

**REPORT OF THE  
FIFTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW  
OF THE  
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE  
(IITA)**

TAC SECRETARIAT  
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

October 2001

# Consultative Group on International Agricultural Research (CGIAR)

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## TECHNICAL ADVISORY COMMITTEE

Emil Q. Javier, Chairman

8 October 2001

Dear Mr. Johnson,

We are pleased to submit to you the Report of the Fifth External Programme and Management Review of IITA, conducted recently by a Panel chaired by Dr. Ken Cassman of the University of Nebraska, USA. The Review Report and IITA's written response to the Report were discussed by TAC at its 81<sup>st</sup> Meeting at CIFOR in Bogor, Indonesia, in September 2001. The Panel Chair made his presentation via tele-conference and power point presentation. Dr. Enrico Porceddu, IITA Board Chair, and Dr. Lukas Brader, IITA Director General were present at the meeting.

The Report of the Panel is accompanied by two attachments. The first contains the TAC Commentary, which summarizes TAC's reaction to the Panel's Report and to the Response of IITA's Board and management. The second attachment is the Response of IITA to the Panel Report.

TAC believes the Panel has carried out a very thorough review of IITA's programmes and management. The report has identified the many strengths of the Centre, its achievements and successes, but also highlighted research and management areas that require strengthening. TAC is pleased to see that the Centre is in agreement with most of the Panel's 17 recommendations and in some cases has already taken concrete steps to address these concerns.

TAC endorses the overall conclusion of the Panel, that IITA's research programmes aimed at poverty reduction, enhancing food security and conserving the environment are making significant contributions to improving the quality of life in sub-Saharan Africa (SSA). TAC believes IITA must remain, now and in the future, a centre of excellence, committed to development-focused agricultural research and capacity strengthening in the service of Western and Central Africa and the rest of SSA.

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Mr. Ian Johnson  
CGIAR Chair  
World Bank  
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Washington, DC 20433  
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Finally, TAC wishes to acknowledge the outstanding commitment and contribution of IITA's Director General, Dr. Lukas Brader. IITA and the CGIAR System at large have benefitted immensely from his fine leadership, insight, dedication and service--all qualities in ample evidence during the past 11 years. He leaves a remarkable legacy.

Yours sincerely,

*(Signed)*

Francisco J. B. Reifschneider  
Director, CGIAR

*(Signed)*

Emil Q. Javier  
TAC Chair

## **TAC Commentary on the Fifth External Programme and Management Review of IITA**

TAC is pleased to accept the report of the Fifth External Programme and Management Review (EPMR) of IITA which was discussed at TAC 81 in the presence of IITA's Board Chair, Dr. Enrico Porceddu and the Director General, Dr. Lukas Brader. The EPMR Panel Chair, Dr. Ken Cassman was unable to attend the meeting in person but addressed the group via a tele-conference call using a power point slide presentation. TAC wishes to thank Ken Cassman and other members of the EPMR Panel for delivering a rigorous and in-depth review and for providing a thorough treatment of the terms of reference.

The report underscores many of the successes and outstanding science accomplishments of many of IITA's programmes. The Panel commends the center for maintaining world-class core competency in plant pest biological control, and exercising strong and effective leadership in germplasm improvement and conservation of the major food crops in SSA. The centre has strong linkages and collaboration with many NARS and sub-regional organizations, and has established effective networks to support breeding efforts and technology transfer of improved crop varieties. There is much to commend.

TAC also appreciates the overall positive response of IITA to the Panel's seventeen recommendations, and is pleased with plans to implement many of them. TAC wishes to comment on several of the recommendations. It appreciates the forward-looking nature of the report, and directs its own comments to that future need.

### **Priority Setting**

TAC commends the extensive effort that IITA makes in its stakeholder consultation process for priority setting. It is a bottom-up process. In such a complex environment with many NARS and other stakeholders, and a very fluid economic and political situation in general, a strictly quantitative, ex-ante impact assessment priority setting process may not be appropriate. Nevertheless, TAC believes that IITA should, in addition to clearly stating its priorities, also provide the reasoning behind them, and develop a quantitative database for each in support of its status. TAC, therefore, endorses the Panel's recommendation on the need for a more transparent and more structured process for setting priorities (Recommendation 1). This is relevant for decision making and resource allocation at the institute level, i.e., for investments across agro-ecological zones and across projects, and down to the project level where decisions about relative emphases across crops, breeding objectives and targeted environments apply. TAC concurs with the Panel's view on the need for achieving a better understanding of the factors leading to changes in use of technology at the farm, regional, and ecoregional level in SSA, as an input into the priority setting process (Recommendation 8). This, combined with knowledge of partners' needs and their strategies, will place IITA in an advantageous position for assessing its own comparative advantage in the global and SSA agricultural research system.

### **Research Leadership**

TAC fully supports the need for recruitment of a DDG for Research (Recommendation 2). It is suggested, however, that this occur as soon as possible after arrival of the new DG to allow the DG's participation in the position description and candidate selection. With all of the demands on a new DG, support of a senior research manager is essential.

### **Research Programmes**

TAC is pleased with the successes and quality of science in crop improvement and plant genetics. The need to clearly articulate priorities and to shift improvement efforts toward IITA's evolving agro-ecological zone focus is encouraged (Recommendations 5 and 7).

TAC shares the Panel's concern with certain issues related to the Resource and Crop Management Division (RCMD). IITA is one of the CGIAR centers that applies the Benchmark Area Approach (BBA) in determining the technological component inputs in a given agro-ecological zone. The Panel noted the significant investment in manpower yet observed a lack of integration of disciplines in field activities at the benchmark sites. They rightly cautioned against further additional investments until the approach had been validated and methods and concepts clarified (Recommendation 7). TAC suggests that an ecosystem framework must be quickly developed for each site, with priority target problems for research and impact. Site "characterization" should be of limited duration, and the research priorities and strategies analysis based on characterization needs further elaboration and clarification. A plan for extrapolation and scaling up should also be immediately put into place. GIS technologies are essential for that process. TAC sees greater emphasis on geo-spatial analysis to be critical (Recommendation 10). IITA must acquire adequate capacity to support the RCMD program.

TAC discussed in some detail the condition of social science research and concurs with the Panel's finding about a lack of coherence in the work undertaken in this domain and agrees with the need for senior leadership for better guidance and integration of social science research into the Centre's overall programme (Recommendation 9). TAC also notes that most studies have focused on technology adoption and ex-post impact analyses and general site characterization work. TAC encourages the social scientists to increase their efforts on a range of other topics, including ex-ante impact assessments (to feed into priority setting), farmer-type typology development, and characterizing household and farm organization and their behavior, among others. This will help in ex-ante tailoring and focusing IITA's crop, biological, and natural resources research towards the priority constraints and potential of small farmers. TAC agrees with the recommendation on the need for recruiting a lead social scientist. As it seeks to fill this much-needed slot for leadership and a stimulus to various efforts in social science and economics, IITA may want to consider various innovative appointment options for filling this critical position.

## **Impact**

TAC appreciates that the Centre took steps to address acknowledged deficiencies in the area of impact assessment (IA), initiating a series of IA studies and hiring an impact generation and assessment specialist. However, many of the impact studies were limited in depth, of variable quality and did not provide a clear picture of the overall extent of IITA's influence. TAC believes the center should strive to carry out more quantitative impact studies that thoroughly document economic and social impacts with explicit linkages to its mission. The Panel identified one study, soybean in Nigeria's southern Guinea savannah, as a useful model for structuring future ex-post IA studies.

## **Quality of Science**

TAC appreciates the efforts of the Panel to evaluate science quality, and shares the Panel's concern with the lack of top-level science publications from some programmes. A range of indicators is needed for assessment of both quality and relevance. The Panel used several. TAC/SC must very quickly assemble and circulate for comment a set of guidelines for assessing quality of science for both individuals and programmes.

## **Board of Trustees**

The report highlights the need for carrying out a programme of Board reform for the Board to exercise its good governance functions (Recommendation 14). TAC supports this recommendation. TAC agrees that the Board should document its responsibilities and accountability more clearly, and strive for shorter, more efficient meetings, conducted in business-like fashion. Given the need for Board reform, it would be advisable for the Board to commission an external review a year or so into the implementation of reform actions.

## **Management**

The Panel commends Centre Management for keeping IITA functioning on a sound financial and operational footing, especially in such a difficult working environment. TAC concurs.

TAC believes that the success of IITA owes much to the leadership and dedication of its outgoing Director General, Lukas Brader. TAC wishes to put on record its appreciation of Dr. Brader for his fine service to IITA and to the CGIAR during the past 11 years.

## **Conclusion**

TAC applauds the work and many accomplishments of the Centre during the past five years and commends the Panel for providing solid evidence in support of this overall very positive assessment. Like the Panel, TAC believes IITA has a major and critical role to play in the future in contributing to improvements in food security and poverty reduction in the SSA.



Headquarters

## International Institute of Tropical Agriculture

(Consultative Group on International Agricultural Research)

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10 May 2001

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Dr. Francisco Reifschneider  
Director  
Consultative Group on International Agricultural Research  
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Dear Emil and Francisco:

It is our pleasure to send you the response to the fifth External Programme and Management Review of the International Institute of Tropical Agriculture. We welcome the constructive comments of the Panel on IITA's present and future capacity to address its mandate, as well as the endorsement of its new Strategic Plan 2001-2010.

The review required hard work and dedication and we would like to express our sincere thanks to all concerned. The review identified certain areas where changes in the Institute's program and strengthening of its capacity would allow it to more effectively address its complex task.

The Institute will carefully analyze the various recommendations and suggestions and will ensure that the best use is made of them. Initial comments and responses to the recommendations are given in the text attached. These have been jointly prepared by the Board of Trustees and IITA Management. The Board will monitor progress on implementation of the recommendations in its future meetings.

IITA looks forward to the future with confidence. The Institute is in an excellent position to effectively support agricultural development in sub-Saharan Africa. It will pursue an active role in building partnerships for implementing a cohesive program of research for sub-Saharan Africa.

Sincerely,

Lukas Brader  
Director General

Enrico Porceddu  
Board Chair

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## **RESPONSE TO THE FIFTH EXTERNAL PROGRAM AND MANAGEMENT REVIEW REPORT OF IITA**

### **PART I: GENERAL COMMENTS**

The External Program and Management Review of IITA was carried out over a period of about one year, beginning with an initial visit by the Chair and a Consultant to study the operations of the Board of Trustees. This was followed by a first visit of the whole Panel between 14 and 25 January 2001 and the final phase of the EPMP took place from 20<sup>th</sup> April to 7<sup>th</sup> May. During this period, the Panel was provided with a wide range of information and had many opportunities for familiarizing itself with the Institute's work. IITA highly appreciates the dedication of all the Panel members and the tremendous amount of work undertaken to complete the Panel's heavy task. We want to express our very sincere thanks to the Chair of the Panel, Dr. Kenneth G. Cassman, and the members for having given so much of their valuable time to the Institute.

The Panel reviewed in detail IITA's draft Strategic Plan for the period 2001-2010 and fully supported the new directions proposed. It also cautions IITA to ensure that effective priority setting instruments are in place and applied to new activities that are being pursued. The Institute had used the priorities of the sub-regional organizations as the basis for the proposals developed in IITA's Strategic Plan, but sees opportunities for refining these following the Panel's recommendations.

IITA fully endorses the Panel's conclusion that "the Institute's research programs are making significant contributions to improving the quality of life in SSA." IITA is encouraged by the Panel's strong endorsement of its various research activities, particularly with respect to crop improvement and plant health management. The Panel saw opportunities for strengthening certain areas of resource and crop management, but it should be noted here that the Institute had already initiated new research in the areas identified.

The Panel gives very high marks to the Institute for its effective linkages with partners ranging from NARS to IARCs. The Institute is pleased that its efforts in that direction have been so successful and that they are well recognized.

The Board has carried out an in depth analysis of the extensive comments on Board governance and will continue to make certain adjustments in its operational procedures. It will keep the matter under further review in future Board meetings.

The Panel spent considerable efforts on checking the quality of IITA's research on the basis of peer reviewed publications and we welcome suggestions made for further improvements while noting that this matter was not emphasized in the 4<sup>th</sup> EPMP. The Panel felt that the CCERs carried out over the past five years did not help it much in its work because they did not adequately address the quality of research. These CCERs were undertaken in particular to address specific areas identified by IITA and, for example, focused more on impact. This

experience shows us that there is a need for clearer guidance from TAC on the terms of reference of CCERs.

IITA welcomes the comments of the Panel on the future research structure and the role of the newly proposed agroecological zone teams and their leaders. This new structure is still under discussion in the Institute. The Board and management prefer that changes take place in an evolutionary manner so that there is an opportunity to evaluate whether such a structure will really strengthen the Institute's operations in the long term.

The Panel has shown an excellent understanding of the funding constraints for agricultural research and in that respect we are pleased that it recommended only a limited number of new positions.

Finally, IITA agrees with the Panel's comments that IITA can play a leadership role at the global and regional levels. IITA intends to continue and intensify its efforts in the development of strong regional CGIAR programs in West and Central Africa and East and Southern Africa.

The Board of Trustees and Management have carefully analyzed the 17 recommendations by the Panel and it is clear that some recommendations need further work. Our specific responses are presented in the following.

## **PART II: RESPONSE TO SPECIFIC RECOMMENDATIONS**

### **Recommendation 1—Prioritization Process**

**The Panel recommends that IITA place immediate emphasis on establishing a sound methodology for prioritizing their research agenda.**

*IITA welcomes this recommendation. In its new strategic plan the Institute has used a bottom-up priority setting exercise based in particular on the priorities developed under the strategic plans of the sub-regional organizations. These plans in turn were based on the strategic plans of the NARS. This collective knowledge and experience of IITA and its partners should be fully considered in any quantitative methodology used. However, the Institute fully acknowledges the potential usefulness of a sound and reliable methodology for prioritizing its research agenda and will undertake the necessary efforts for this. It will consult with its sister institutes and others to determine the best approach. The institute hopes that adequate reliable data are available to allow it to achieve trustworthy results.*

### **Recommendation 2 – From Strategy to Structure: A Work in Progress**

**The Panel recommends immediate recruitment of a DDG-R with responsibility to guide and manage IITA's research program, evaluate its quality and relevance, and be accountable.**

*Following the recommendation of the fourth EPMR IITA proceeded with the recruitment of a Deputy Director General. Once the new staff member was identified the Institute looked at how the research leadership could be best organized. Given the current strength and interest of the Director General, it was decided that this could best be done by having a Deputy Director General at large with extensive responsibilities for research planning and management. However, it was felt also that the Director General should maintain an active role in research planning by continuing to chair the Research Program and Executive Committee. After the retirement of the current DG the DDG's position could be formally denominated DDG Research. At IITA the three research divisions enjoy strong scientific leadership. Even in the future the Institute should continue to benefit fully from its combined research leadership capacity. Moreover, the incoming DG should be given the opportunity to make changes as appropriate.*

### **Crop Improvement and Plant Genetics**

**Recommendation 3. The Panel recommends that IITA develop a concept and approach for yam ideotype breeding with the objective to render production less labor intensive in a systems approach.**

*IITA agrees with the recommendation of the Panel. Because in many yam-growing areas, the most serious constraints to productivity are the high costs of planting material and of labour for field operations like land preparation, planting, staking, weeding and harvesting. Studies in yam physiology and agronomy, currently in progress, are defining plant characteristics that would lead to increased production but reduce labour requirement in yam cultivation. For instance IITA and some NARS partners have demonstrated differential responses of yam genotypes to staking. There is also the potential for dwarfing to obviate the need for staking, as established by the selection of dwarf and semi-dwarf plant types from *Dioscorea rotundata* (white Guinea yam) populations sent by IITA to CTCRI in India in the 1970s.*

*Likewise, hybridisation between *D. rotundata* and *D. alata* (water yam) could lead to a valuable combination of attributes that would make the product superior to either species. This is because *D. alata* is superior to *D. rotundata* in terms of factors such as yield potential (especially under low to average soil fertility), ease of propagation (production of bulbils and reliability of sprouting), early vigour for weed suppression, and storability of tubers. Efforts will continue towards the production of viable hybrids between these two major species.*

**Recommendation 4. The Panel recommends that IITA initiate in the framework of CORAF/WECARD, a regional scientists' forum on the development and use of genetically modified crops, which gives NARS scientists a sense of co-ownership in transgenics research and might serve as the nucleus for a future network.**

*IITA agrees with this recommendation, including the possibility of extending the initiative beyond the CORAF/WECARD region/membership. IITA has been engaged in such activities since the 1990s. IITA organized three workshops for Nigerian scientists who were to form the core staff to implement the biosafety guidelines for the country. These workshops took place in 1993, 1994, and 1999. The 1994 workshop used the Nigerian Biosafety Guidelines, which IITA*

*helped to draft as a working document. This year IITA is planning a workshop on biosafety for scientists and other stakeholders from some West African countries with funding provided by The Gatsby Charitable Foundation. In addition, a USAID funded workshop will be held at IITA from 28 to 31 May 2001 between Nigerian, Ghanaian and IITA biotechnologists to strengthen research collaboration among the participants and with partners in USDA and US Universities. Biosafety issues will be included in the discussion at this workshop. Moreover, the Global Biodiversity Institute (USA) and IITA conducted in March 2001 a one-month course on biodiversity, biotechnology and law for 40 participants (scientists, lawyers and policy makers) from 9 sub-Saharan African countries. The Institute is concerned about the slow progress in the implementation of biosafety guidelines in countries in sub-Saharan Africa.*

**Recommendation 5. The Panel recommends that IITA develop clear priorities for crop improvement research, structured and justified on the basis of relevance to the target environments and users, the Institute's comparative advantage, and the prospects for achieving impact.**

*IITA acknowledges this recommendation. Priorities for crop improvement research, have been established based on expressed needs of partners (NARS, SROs, NGOs, farmers and other end-users) after due consultation in several fora (network/collaborative meetings, symposia, workshops, farmer field days) as well as baseline studies for some crops in target environments, e.g. COSCA. Additional regional objectives from SROs were included based on the market and end-user demands such as high protein, micro-nutrients, nutritional qualities and other post-harvest characteristics. The relative distribution of the Institute's research capacity over each of the six mandate crops is largely a reflection of the economic importance of these crops in sub-Saharan Africa. With emerging needs of the ecoregional and agro-ecozone orientation of research at IITA, prioritization will be further refined, particularly for selection of the most appropriate biotech approaches for crop improvement in sub-Saharan Africa.*

### **Review of Biological Control and Integrated Pest Management**

**Recommendation 6 The Panel is concerned that productivity in PHMD appears to be declining. The Panel recommends that IITA assess the research output of all IRS and NRS to help maintain PHMD's world-wide reputation in biological control and IPM.**

*IITA is also concerned about a gradual decline in scientific output as measured by the number of peer-reviewed journal articles produced by the Plant Health Management Division. To some extent, the decline in the number of peer-reviewed publications per scientist is explained by the fact that departing principal staff had a long career of scientific publishing, often on laboratory or process studies. The institute is also concerned that the success in biological control of cassava green mite has been largely undocumented and shall take appropriate action. The shift towards long-term field and impact studies inherent in maturing projects and recommended by the previous EPMR naturally led to a reduced frequency of publications. IITA recognises that some scientists who are involved in special projects concerning implementation over several countries have not published in peer reviewed journals. Their impact has been in writing training manuals or monographs, or in giving training courses or bench training to national staff. Notwithstanding this commendable effort, we are urging them to present the process and*

*impact of technology transfer in appropriate journals and to integrate the corresponding literature on farmers' participatory research and similar topics.*

### **Resource and Crop Management Research**

**Recommendation 7.** The Panel recommends that RCMD develop a clear business plan for each of its project components; identifying clear outputs by expected time lines that are substantiated by peer-reviewed publications; and particularly with respect to the concepts and methodologies of the benchmark approach.

*IITA accepts the tenor of this recommendation but notes that detailed logframes with outputs, milestones and means of verification are available for projects 11 – 14, as is the case for all the projects carried out by the Institute. These are reviewed annually and upgraded in preparation for work planning week at IITA. The Institute acknowledges that peer reviewed publications detailing the methods and concepts on the benchmark approach have been somewhat lacking in the past; however, just such a publication is proposed for presentation at the next CGIAR INRM annual conference at CIAT in August 2001 and will be subsequently published in a suitable peer reviewed journal. More emphasis will be placed on this aspect of publication in the future. In addition, further efforts to associate project outputs with peer reviewed publications will continue the trend established after 1999 following the CCER which led to the establishment of the current projects 11-14.*

**Recommendation 8:** The Panel recommends that RCMD lead a concerted effort to fully understand the driving forces, extent, rates, and types of cropping system intensification in the major AEZs of West and Central Africa (wet and dry savannas and humid forest), using innovative approaches and appropriate partnerships.

*IITA accepts that understanding the major driving forces behind cropping system intensification allows not only prediction of problems that will occur during the intensification process, but also insight into potential solutions. These concepts were developed in the early 1990s and published in the mid 1990s by Smith, Weber and Manyong and incorporated into the theory underpinning the size of benchmark areas, i.e. large enough to contain gradients in intensification as well as different driving forces such as population and market access. IITA concurs with the need to analyze the data that have been collected in 5 EPHTA benchmark areas and will therefore step up the analytical effort, particularly with regard to how the driving forces are impacting on the adoption of IITA technologies.*

**Recommendation 9:** The Panel recommends that research capacity in the social sciences at IITA be strengthened, through two actions:

- **appointing an eminent agricultural economist to provide leadership and cohesion to the socio-economic research activities; and**
- **ensuring representation of a senior economist on the RPEC.**

*An additional social scientist IRS position added to RCMD project 14 team would be welcomed by IITA particularly a scientist with experience in policy, agricultural economics and other issues. However, IITA needs to treat this recommendation pragmatically, as the availability of*

*such senior candidates with the willingness to be based in West Africa is very limited. In addition, IITA is pleased to note the recent stronger leadership and cohesion in social sciences resulting from the re-organization of Project 14, and its complementary alignment with projects 11-13 since the 1999 CCER.*

*Representation of a senior social scientist on the RPEC is in theory desirable but would be dependent on the outcome of current IITA restructuring at senior management level.*

**Recommendation 10: The Panel recommends greater emphasis on the development of geo-spatial analysis capabilities within IITA coordinated with other ongoing programmes in the CGIAR System and with appropriate ARIs.**

*IITA fully endorses an increased emphasis on geo-spatial analysis capabilities and has been retooling capacity since late 2000. IITA will upgrade the current core post-doc GIS specialist position to that of full international staff level. IITA has joined the CGIAR Consortium for Spatial Information in 2001 and is developing closer GIS links with WARDA and ICRISAT in West Africa in particular. It also has further plans to cement its continued linkage with ARIs, in particular Yale University Centre for Earth Observation (for remote sensing) and Mud Springs Geographers Inc., the Regional Center for Training in GIS and Remote Sensing (RECTAS) in west Africa at Ife, Nigeria and with the United States Geological Survey (for GIS data). GIS work is expanding at village and benchmark level through existing CGIAR Alternatives to Slash and Burn Agriculture Consortium partners. IITA will also seek other ARI partnerships where appropriate in the future.*

### **Research Support**

**Recommendation 11. The Panel recommends that the Center develop a specific strategy on information dissemination and training, particularly emphasizing mid-career scientist development for researchers from national programs, even at the expense of some postgraduate training.**

*The institute accepts this recommendation while noting that over the last five years it has implemented a deliberate policy of outsourcing to relevant NARS the organization of most group training courses.*

**Recommendation 12. The Panel recommends that IITA act now to fully implement its new IPR policy, namely:**

- **Ensure that it has freedom to operate (FTO) in its present operations**
- **Put in place an infrastructure to ensure that all future IP issues be monitored and databased.**
- **Ensure that IITA's IP policies effectively cover its designated germplasm, breeding products, publications, databases, trademarks and proprietary technologies.**
- **Periodically review the IPR policy in the light of evolving international regulations and conventions.**

*IITA accepts the recommendation to fully implement the new Board approved (May 2001) IPR policy and to:*

- *continue to check that it has freedom to operate in its present operations,*
- *make any necessary modifications to its Research Database Management System (RDBMS), with advice from the CGIAR Central Advisory Service (CAS), to ensure that information on IITA generated intellectual property is properly stored,*
- *ensure that the IITA policies do effectively cover all of IITA's intellectual properties,*
- *keep under periodic review the IPR Policy in light of changes in IITA's operating environment.*

## **Private Sector**

**Recommendation 13.** The Panel recommends that IITA work more closely with IFDC, IFPRI and other international partners to achieve a better understanding of constraints to adoption and performance of its improved varieties, with particular consideration given to the agricultural input sector of Nigeria and other countries.

*IITA is already working closely with IFDC as co-members of the CGIAR Systems –wide Initiative on Soil Water and Nutrient Management (coordinated by CIAT), as part of the “Best Bets” group working in the dry savannas of Nigeria, Niger and Mali funded by the Systems-wide Livestock Program (coordinated by ILRI) and in the specific case of seed and inputs has recently collaborated with IFDC and WARDA in preparing a review of the constraints in the agricultural input sector in Nigeria “Agricultural Input Markets in Nigeria: An Assessment and a Strategy for Development”. 2000, IFDC, Muscle Shoals, Alabama. This has led to a major funding proposal to USAID “Management of Agricultural Inputs” project in which IFDC and IITA are the major partners and IITA has responsibility for the outputs concerning the seed industry.*

*IFDC and IITA are also initiating collaboration in GIS and modelling issues. With IFPRI, IITA is collaborating on the 2020 projection study and with USDA, IFDC and others in the “Africa Trade and Investment Policy Programme” in association with the West African Seed Network the coordination of which will shortly be transferred from Ghana to IITA Ibadan. IITA will continue to collaborate with complementary partners in the complex issues surrounding the input sector in West Africa.*

## **Board of Trustees**

**Recommendation 14.** The Panel recommends that the Board carry out a programme of Board reform that includes, in particular:

- returning to two meetings a year of the full Board,
- reducing the number of members on the Board of Trustees, including the number of host country members
- defining the term of office of the Board Chair
- reducing the time taken at Board meetings for formal execution of its responsibilities,
- establishing, documenting and committing to ‘best practice’ procedures for the Board and its committees
- providing a budget for the Board Chair, and
- commissioning a CCER on Board governance approximately one year after the new DG has taken up his or her appointment.

*The Board was pleased to read – page 76—“In 2000 the 13 members elected at large provided an appropriate representation of gender, north/south and discipline dimensions,” and page 77, “The Board gives the impression of being willing to carry out its responsibilities and at one level functions at its meeting in an active, engaged manner.”*

*In 1997, the Board conducted a self-assessment using the forms recommended by the CG Secretariat. As a result of this exercise in 1998, the bylaws and board policies and procedures were amended and a Trustees conflict of interest was adopted. The Board also decided to assess Board and DG performance in written form every other year. A draft of a Board policy manual specifying governance style, Board/DG linkages and executive limitations was prepared as a result of 2000 Board of Trustees meeting to be discussed and approved at the May meeting in 2001 as proposed at the Executive Committee in February 2001. Further improvements may be introduced after the establishment agreement has been revised and the future of the CGIAR is more clearly defined.*

- *The Board of Trustees had already agreed to meet for a second time in 2001 at the end of November. The Panel's recommendation confirms the need for this and is accepted by the Board. It will contribute to inclusiveness in the Board.*
- *The Board recognized that a smaller Board would further enhance inclusiveness and help to mitigate the costs of reverting to two Board meetings a year. It agrees that in the context of a smaller Board, a reduction in the number of host-country members would have to be considered. Against the reduction is the complexity of IITA's mandate, the disciplinary diversity of its staff and the variety of its activities along the research continuum. There is no guarantee that absentees would reduce and this might penalize the ability of a smaller Board to have a properly rounded discussion on some issues.*
- *The term of office of the Board Chair is specified in the By-Laws and Policies and Rules of Procedures of the IITA Board of Trustees, which state "the Chair and Vice-Chair may not serve for more than three consecutive years." Extension of the term of the current Chair was a decision taken in the light of the timing of the 5<sup>th</sup> EPMR and the Search for a new Director General. The Board considered it important for the existing Chair to see such critical Board processes to a successful conclusion.*
- *The Board is unclear on the exact meaning of this recommendation. The text of the report and the consultant's larger report see greater formality in several aspects of the evaluation and performance monitoring (paragraphs 5.1.4 and 5.1.6). It is unclear whether this could or should reduce the time taken at meetings. Clarification is requested.*
- *As mentioned in the preamble, revision of the Board policy manual, revision of practices are in progress. The Board accepts the recommendation.*
- *The Board was unable to find a reference to this recommendation in the text of this report. Nor does it appear in the extended report by the Consultant, either as a recommendation or in the text. In the past the Board has encountered no difficulties in ensuring the funding of specific initiatives, hence it does not see a justification for providing a special budget for the Board Chair in the future.*
- *The Board notes that this recommendation is not consistent with the Panel's advice (though not a recommendation) in paragraph 3.1.23. i.e., "The Panel also considers that the CCERs should be conducted within two years of the next 5 year review."*

*The Board will monitor progress in implementing the EPMP recommendations on governance and at its meeting in May 2002 further consider the need and time of a CCER on this topic.*

## **Human Resources**

**Recommendation 15.** The Panel recommends that a single manager oversees the human resource function, reporting to the Director of CSD, and secondly, that there is a greater degree of flexibility in its NRS scientist policies to ensure consistency between the administrative and research staff and among the CGIAR Centres operating at one station.

*IITA does not see the benefit of one single manager overseeing the human resource function and cannot find significant arguments for it in the Panel's report. The two positions require very different skills and experience that are adequately met under the current arrangements.*

*In recent years, the Institute has actively tried to reduce the International Staff in research support, administrative and service functions and replace them by well-qualified national staff. Such staff can only be attracted and maintained by paying salaries comparable to those in the industrial sector around us. The Institute is not in the strict sense employing NRS scientists; these are all classified as research associates. These staff members are encouraged to pursue MSc or Ph.D research. Once they have obtained a Ph.D they are eligible to apply for international positions at IITA or seek employment in their national institutions. IITA does not wish to employ two categories of scientists; this is contrary to its recruitment policies, and can lead to significant staff dissatisfaction.*

## **Finance**

**Recommendation 16.** In sum the Panel recommends that the following steps be taken with regard to financial management:

- **putting in place an effective internal audit function**
- **a comprehensive framework for the installation of the Oracle-based MIS/FIS be put in place**
- **consideration be given to engaging on overseas development officer**
- **adoption of an overhead charge policy.**

*Steps have already been taken to maintain an effective internal audit function.*

*A steering committee for the installation of the Oracle MIS/FIS has been established; additional resources, financial and human, have also been made available to the project.*

*The Institute will look into possibilities of how the activities to be undertaken by an Overseas Development Officer can best be fulfilled, and in particular in a cost effective manner.*

*The Institute in principle charges the overhead percentage calculated on the basis of the latest CGIAR methodology. There are a number of situations where, for a variety of reasons donors*

*do not accept this full percentage, and it is the DG's responsibility to negotiate the best rate, keeping in mind the interest of the research program of IITA.*

**Recommendation 17. The Panel recommends that the status and importance of the position of the Head of the External Liaison Office be upgraded, but not to DDG level.**

*After very careful analysis of the best way to strengthen the relationships with NARS, the Institute decided that this could be done more effectively by integrating the relevant activities to be undertaken into each of the projects. As a result the responsibilities of the External Liaison Office became more focused. It is evident from the Panel's own discussion of IITA's partnership and linkages that this change has been very beneficial. Consequently, the Institute sees the present model as more than adequate to meet its needs.*

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6 May 2001

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Dear Drs. Javier and Reifschneider,

On behalf of the Panel, I am pleased to submit to you the Report of the Fifth External Programme and Management Review (EPMR) of the International Institute of Tropical Agriculture (IITA). The Panel has reviewed, as requested, the research programme and management aspects of the Centre making every effort to present an accurate account of the outputs, achievements and what is known about the impact of the Centre during the review period.

IITA is, like the CGIAR itself, on the verge of a new era. The challenge is especially great for IITA as it moves forward under new leadership and guided by a new strategic plan. We have noted in this report the many strengths of the Centre and its critical role in conducting research aimed at poverty alleviation, enhancing food security and sustaining the environment in sub-Saharan Africa. Although we highlight in the report several areas in need of strengthening, the Panel is unanimous in its view that there are exciting opportunities for IITA to exert its leadership as the premier international agricultural research organization in SSA. This owes much to the fine leadership and dedication of the person who has steered this institute during the last 10 years, Dr. Lukas Brader.

This review was, by all accounts, a very a challenging assignment, but one which I and the members of this Panel found stimulating. I would like to take this opportunity to thank you for assembling such an able and experienced team for this task. Notwithstanding the tough debates and long hours, the Panel worked exceedingly well together, with incredible energy and commitment. On behalf of the Panel, I would like to express our sincere appreciation for the contributions of our two consultants, Michael Gale and Julie Noolan, who shared the same sense of purpose and level of commitment as the Panel did. They were essential to this review.

I appreciate the opportunity to have served as chair of the review team. I trust our review will prove useful to the CGIAR members, TAC, and to the Centre.

Yours sincerely,

Ken Cassman, Chair  
External Review Panel

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

**REPORT OF THE  
FIFTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW  
OF THE  
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE  
(IITA)**

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TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

May 2001



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## PREFACE

This is the report of the Fifth External Programme and Management Review (EPMR) Panel appointed to evaluate the research programme and management of the International Institute of Tropical Agriculture (IITA). The composition of the Review Panel is listed in Annex I along with brief biodata. The Terms of Reference for this Review are found in Annex II. The Panel's itineraries during the Initial and Main Phases are provided in Annex III.

In producing its report, the Panel was guided by the two broad objectives of EPMRs: (a) providing CGIAR members with an independent and rigorous assessment of the institutional health and contribution of the Centre; and (b) providing the Centre and its collaborators with assessment information that complements or validates their own evaluation efforts. The Panel made every effort in this report to present an accurate account of the outputs, achievements and what is known about the impact of IITA during the review period.

With respect to the conduct of its review, the Panel relied on numerous sources of information in reaching its conclusions and making its recommendations. These were the following:

- documentation provided by the Centre and the TAC and CGIAR Secretariats (Annex IV);
- IITA staff presentations given during the Initial Phase of the review at HQ and IITA stations in Kano, Yaoundé and Cotonou (14-25 January 2001) and immediately preceding the Main Phase in Kampala (16-19 April 2001);
- follow-up discussions with Divisional leaders and project scientists and other staff groups at IITA HQ during both the Initial Phase and the Main Phase (20 April – 7 May 2001);
- meetings and discussions with government officials, NARS scientists, representatives of regional and sub-regional organizations and networks, university collaborators, NGOs and farmers associated with IITA's programmes in Nigeria, Cameroon, Benin, Ghana, and Uganda;
- visits to NAROs research stations and farmers fields in or near Kano, Yaounde, Kampala, and Cotonou and extensive follow-up discussions with IITA staff in the field;
- information derived from the IRS staff survey (March, 2001);
- review of Board agendas, minutes and other documentation, observations of the Board in action (Board Meeting, May 2000) and direct interaction with Board members individually; and,
- discussions with individuals representing private and public sector donors, other CGIAR Centres, and CGIAR cosponsors, in person and through e-mail correspondence.

For this review, the Panel took as its departure point the major recommendations from the 1996 EPMR. These recommendations, the Centre's updated response to them, and a brief commentary by the current Panel on the adequacy of those responses, can be found in Annex V.

The Panel made every attempt to conduct the review in an objective and transparent manner with a focus to the future as well as to the past. The Centre was kept informed of the

Panel's activities and progress through the review. Key issues identified by the Panel at the conclusion of the Initial Phase were discussed with senior management of the Centre. As they were completed, drafts of various chapters of the report were shared with the Centre for comments and to check for factual accuracy prior to finalizing the report.

Because of time constraints, the Panel could not go in detail into every element of the Centre but chose to focus on what it believed were the most significant issues. For example, after visits and discussions at Kano, Yaoundé, Cotonou, and Accra during the initial phase, based on a consistently favourable impression of IITA-NAROs relations, the Panel chose not to conduct a formal survey of NAROs in the region. However, the Panel did spend considerable time meeting various government officials, regional and subregional organization leaders and other IITA collaborators.

Most other CGIAR Centres (including those with whom IITA has active collaboration) provided comments - almost all very positive - about the nature of the collaboration with IITA and about the nature of their collaboration with IITA. These reports indicated good relationships with other IARCs. The Panel found this information useful in making its assessment of the Centre. Finally, during the course of the review, the Panel encouraged staff to contact them (confidentially) if they had any concerns or issues to discuss.

## **SUMMARY AND RECOMMENDATIONS**

### **Introduction**

This review covers the period since the 4<sup>th</sup> EPMR, which was completed in 1996. During this period, both internal and external environments in which IITA operates have changed markedly. The current Director General (DG) is soon to complete a term of 11 years and has provided strong leadership and institutional stability in a difficult operating environment. The Chair of the Board of Trustees will end a six-year term and a draft Strategic Plan for 2001-2010 heralds new research directions and partnerships. The Panel also notes an increasing emphasis on a regional research approach and global challenge programmes within the CGIAR.

External to the Centre, there has been an accelerating pace of innovation in the basic sciences and information technology, trade liberalisation, greater concern about intellectual property rights, and rapid economic development in most regions of the world. Unfortunately, sub-Saharan African has not shared equally in this prosperity as a result of political upheaval, inappropriate policies, and rapid population growth.

Given these dynamic internal and external forces, the Panel conducted the 5<sup>th</sup> EPMR of IITA with a strong forward-looking perspective. We have attempted a rigorous and comprehensive review that included meetings with IITA scientists and administrators, site visits to stations in five countries, and meetings with NARS stakeholders, though we recognise it was not possible to see all aspects of IITA's work. At the completion of our assignment, we conclude "the Institute's research programmes are making significant contributions to improving the quality of life in SSA" (Chapter 6).

### **Mission, Strategy, and Priorities**

Although 65 % of the population in SSA is employed in the agricultural sector, support for agriculture research and extension has received low priority. Because overall economic development must be built upon strong agricultural growth, the Panel believes that the need for IITA today is more pressing than it was when it was first established more than 30 years ago. The Centre's mission statement is consistent with the CGIAR goals of reducing poverty, hunger and malnutrition by increasing the productivity of resources in agriculture. Its objectives are sound.

IITA's draft strategy for 2001-2010 proposes new modes of conducting research, based on strong partnerships with sub-regional research organizations (SROs), and a wide range of stakeholders in the National Agricultural Research Systems (NARS). Compared to the previous strategy, it emphasises an agroecological zone (AEZ) framework and a demand-driven approach for identifying research needs and understanding the biophysical and socio-economic dynamics of the agricultural intensification process. The Panel supports these shifts in programme emphasis.

The Panel did not find clear priorities or a transparent process for setting the research agenda. We believe there is need for a Deputy Director General for Research (DDG-R) to ensure rigour and co-ordination throughout the Centre's research programmes in support of the new DG, especially given the increasing emphasis on a regional research approach within West and Central Africa (WCA) and global challenge programmes in the CGIAR.

### **Quality and Relevance of Science**

***Crop Improvement.*** IITA has a global mandate for yam and cowpea, and regional mandates for cassava, plantain, soybean and maize. The Panel commends the Crop Improvement Division (CID) for excellent progress in developing varieties of these crops with higher and more stable yields than germplasm currently used by farmers. Research quality was enhanced by the use of new methods: flow cytometry on *Musa*, development of molecular markers for use in breeding, low-cost screening methods for physiological and quality traits in cowpea, and innovative approaches for vegetative propagation of tuber crops. Sustaining these strengths will require improved prioritization of breeding objectives, greater integration of the crop improvement research with other disciplines—especially within the AEZ framework—and a clear strategy for the use of biotechnology in crop improvement. Publication output and quality were good given the emphasis on germplasm development. Efforts are encouraged to ensure an appropriate balance between germplasm development and scientific understanding of the basis for genetic gains.

***Plant Health Management.*** The quality and relevance of research conducted by the Plant Health Management Division (PHMD) group is highly commendable. Biological control research and implementation have made excellent contributions to solving pest problems of resource poor farmers in SSA while producing strong scientific outputs. PHMD scientists have made extensive use of modelling and multivariate analyses in assessing ecological relationships in biological control. The methods developed for assessing losses in yield and quality from grainborers in maize sets new standards for such work. Other areas of strength are the biosystematics, virology, and germplasm health units. Training of African scientists and strengthening NARS capacity in biological control and integrated pest management are additional features of this work. Publication productivity was excellent and the Panel urges continued emphasis on maintaining the world-class reputation of this unit.

***Resource and Crop Management.*** The Resource and Crop Management Division (RCMD) accounts for nearly 40 % of IITA's research investment. In the past five years, RCMD research has placed greater emphasis on: (i) a participatory research approach to identify stakeholder needs and implement more sustainable cropping systems in the moist savannahs and humid forest AEZs; (ii) a multi-disciplinary approach to understand interactions between the biophysical and socio-economic features of selected benchmark areas; and, (iii) impact assessments on improved cereal-legume cropping systems and reasons for low adoption of alley farming systems. Since the last EPMR, productivity and quality of RCMD research remains below the expectations of an international centre and publication output is very uneven across the group. Future plans call for greater use of advanced GIS and modelling applications, and further extension of the benchmark approach. These and other methodological developments will require rigorous testing of hypotheses and better definition for effective implementation. Greater

collaboration is encouraged with ARIs and other IARCs that have complementary research capacities in key areas.

***Social Science.*** Although IITA's social science is mostly housed within the RCMD, the Panel gave it separate coverage. Social science research in the past five years has focussed on systems characterization, impact assessment, and market and consumer demand studies. While this work has been used by the Centre to better understand the determinants and impact of technology adoption, it has not been rigorously validated by peer review through publication in discipline-based journals. Greater cohesion and leadership are needed to guide the social science research effort within research projects, and to provide rigorous intellectual challenge to the basic assumptions that drive the overall research agenda.

### **Impact and Accomplishments**

The Panel found strong evidence of impact from the Centre's research on biological control and germplasm development. Effective collaboration with NAROs has resulted in the establishment of biological control for a number of important pests of major crops in WCA. In crop improvement, the Centre released 41 cassava varieties and 44 maize varieties to NARS and estimates that the resulting increase in yields would feed an additional 100 million people in SSA. Improved varieties and disease-free planting materials of the other mandate crops also have been widely distributed through networks and research collaboration with the NARS. Improved legume-cereal cropping systems are beginning to be adopted in some areas of the dry savannah AEZ as a result of the interdisciplinary research conducted by the RCMD. Despite greater attention to impact assessment during the past five years, the Panel believes more thorough documentation is needed with explicit linkages to its mission.

Clear progress has been made on establishing stronger linkages with a wide range of NARS stakeholders and in co-ordinating the Centre's strategic planning efforts with the SROs. Strong networks are in place to support breeding efforts and technology transfer of improved varieties by NARS and NGOs. The Centre has continued to build NARS capacity through training activities. The Panel commends IITA for its proactive and successful efforts to strengthen collaboration and partnerships with the NARS.

### **Governance and Management**

Boards world-wide are paying more attention to their good governance function and IITA's BoT needs to keep pace with this shift in emphasis. The Panel highlights the need to streamline activities, meet more often, and document its responsibilities and accountability.

Management has done an extraordinary job in keeping IITA functioning on a sound financial and operational footing in a difficult environment. The Panel believes, however, that the new DG must make a series of organizational changes in financial management and training of personnel, and to ensure that a number of steps will be taken to counteract the constant erosion of funding. Improved overhead return on donor contributions needs attention.

**Conclusions**

The Panel believes that IITA must be maintained. It is faced with a difficult operating environment, a complex agricultural sector, and farming systems that are both intensifying in place and expanding into marginal soil areas or humid forests that are a storehouse of biodiversity. To succeed in its mission, IITA must carefully focus and prioritize its research efforts. It also needs to attract and retain the best scientists available. The challenge for the new DG is to sustain and energize the Institute to ensure it remains a world-class research institution.

## **LIST OF RECOMMENDATIONS**

### **Prioritization Process (Section 2.2.1)**

1. The Panel recommends that IITA place immediate emphasis on establishing a sound methodology for prioritizing their research agenda.

### **From Strategy to Structure: A Work in Progress (Section 2.4)**

2. The Panel recommends immediate recruitment of a DDG-R with responsibility to guide and manage IITA's research programme, evaluate its quality and relevance, and be accountable.

### **Crop Improvement and Plant Genetics (Section 3.2)**

3. The Panel recommends that IITA develop a concept and approach for yam ideotype breeding with the objective to render production less labour intensive in a systems approach.
4. The Panel recommends that IITA initiate in the framework of CORAF/WECARD, a regional scientists' forum on the development and use of genetically modified crops, which gives NARS scientists a sense of co-ownership in transgenics research and might serve as the nucleus for a future network.
5. The Panel recommends that IITA develop clear priorities for crop improvement research, structured and justified on the basis of relevance to the target environments and users, the Institute's comparative advantage, and the prospects for achieving impact.

### **Review of Biological Control and Integrated Pest Management (Section 3.3)**

6. The Panel recommends that IITA assess the research output of all IRS and NRS to help maintain PHMD's world-wide reputation in biological control and IPM.

### **Resource and Crop Management Research (Section 3.4)**

7. The Panel recommends that RCMD develop a clear business plan for each of its project components; identifying clear outputs by expected time-lines that are substantiated by peer-reviewed publications; and particularly with respect to the concepts and methodologies of the benchmark approach.
8. The Panel recommends that RCMD lead a concerted effort to fully understand the driving forces, extent, rates and types of cropping system intensification in the major AEZs of

West and Central Africa (wet and dry savannahs and humid forest), using innovative approaches and appropriate partnerships.

### **Social Sciences and Impact Assessment (3.5)**

9. The Panel recommends that research capacity in the social sciences at IITA be strengthened, through two actions:
  - appointing an eminent agricultural economist to provide leadership and cohesion to the socio-economic research activities; and
  - ensuring representation of a senior economist on the Research Programme and Executive Committee (RPEC).

### **Geo-Spatial Analysis and Crop Systems Modelling (Section 3.6)**

10. The Panel recommends greater emphasis on the development of geo-spatial analysis capabilities within IITA, co-ordinated with other ongoing programmes in the CGIAR System and with appropriate ARIs.

### **Research Support (Section 3.7)**

11. The Panel recommends that the Centre develop a specific strategy on information dissemination and training, particularly emphasizing mid-career scientist development for researchers from national programmes, even at the expense of some postgraduate training.
12. The Panel recommends that IITA act now to fully implement its new IPR policy, namely:
  - ensure that it has freedom to operate (FTO) in its present operations;
  - put in place an infrastructure to ensure that all future IP issues be monitored and databased;
  - ensure that IITA's IP policies effectively cover its designated germplasm, breeding products, publications, databases, trademarks and proprietary technologies; and
  - periodically review the IPR policy in the light of evolving international regulations and conventions.

### **Private Sector (Section 4.5)**

13. The Panel recommends that IITA work more closely with IFDC, IFPRI and other international partners to achieve a better understanding of constraints to the adoption and performance of its improved varieties, with particular consideration given to the agricultural input sector in Nigeria and other countries.

### **Board of Trustees (Section 5.1)**

14. The Panel recommends that the Board carry out a programme of Board reform that includes, in particular:

- returning to two meetings a year of the full Board;
- reducing the number of members on the Board of Trustees, including the number of host country members;
- defining the term of office of the Board Chair;
- reducing the time taken at Board meetings for formal execution of its responsibilities;
- establishing, documenting, and committing to "best practice" procedures for the Board and its committees;
- providing a budget for the Board Chair; and
- commissioning a CCER on Board governance approximately one year after the new DG has taken up his or her appointment.

#### **Human Resources (Section 5.4)**

15. The Panel recommends that a single manager oversees the human resource function, reporting to the Director of the CSD, and secondly, that there is a greater degree of flexibility in its NRS scientist policies to ensure consistency between the administrative and research staff and among the CGIAR Centres operating at one station.

#### **Finance (Section 5.5)**

16. The Panel recommends that the following steps be taken with regard to financial management:
  - putting in place an effective internal audit function;
  - a comprehensive framework for the installation of the Oracle-based MIS/FIS be put in place;
  - consideration be given to engaging an overseas development officer; and
  - adoption and rigorous implementation of an overhead charge policy.
17. The Panel recommends that the status and importance of the position of the Head of the Executive Liaison Office be upgraded, but not to DDG level.

## CHAPTER 1 - BACKGROUND AND CONTEXT

There can be no doubt about the impact of the combined national and international research effort on major food crops during the past 30 years in sub Saharan Africa (SSA). Sustained research efforts effectively co-ordinated across CGIAR centres, national programmes, and NGOs, led to the development, introduction and adoption of more productive varieties of maize, cassava, paddy, cowpea and a host of other major food crops in SSA<sup>1</sup>. It is estimated that the research effort on maize has resulted in an annual increase of 8 million tonnes grain in SSA. For cassava, one of the most important staple commodities in West Africa, widespread famine was likely avoided due to research leading to effective biological control of the cassava mealybug. For these two crops alone, research has meant that over 100 million more people can be fed. Such are the results and promise of agricultural research in one of the poorest geographic areas of the world. But the challenge ahead remains formidable.

Notwithstanding these and other research success stories, SSA is home to most of the world's poorest countries. Undernourishment and low food availability predominate and prospects for rapid economic growth to alleviate these conditions appear limited. With more than a third of the population estimated to be undernourished, the depth of hunger and food insecurity in SSA is greater than anywhere else (FAO, 2000).

### 1.1 The Agricultural and Economic Environment of Sub-Saharan Africa

Rural development is the key to reducing poverty and enhancing food security in SSA. Most of the population and natural resources in this region are found in rural areas, and much of the human and natural capital in the region represent a vast pool of under-utilized potential. Though it varies by sub-region, between 60 and 70% of the people in SSA live in rural areas, and most derive their income and sustenance directly or indirectly from agriculture.

Agriculture is therefore critical to Africa's economic, social and rural development, and increased productivity and conservation of natural resources in the agricultural sector is the key to sustainable development. As the fundamental economic activity in most African countries, agriculture remains the backbone of most of the economies of SSA and will remain so in the foreseeable future. It accounts for about 35% of the continent's GDP, 40% of its exports, and about 70% of its employment. Sluggish agricultural development is a principal reason for disappointing economic growth and the continuing poverty on the continent.

The SSA region has a rich agricultural base spread over a wide range of environmental conditions. It has the potential for producing enough staple food and cash crops to feed its populations as well as for generating a viable and competitive regional market for a wide range of cereals, legumes, root and tuber crops, livestock, forestry products and fisheries. Despite this potential, African agricultural production in the past two decades has not kept pace with

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<sup>1</sup> See, for example, the recent draft Contributions by the CGIAR and its Partners to Agricultural Development in sub Saharan Africa (TAC Secretariat, 2001).

population growth. Without substantial improvements in agricultural productivity and sound natural resource management, rural dwellers in SSA will continue to struggle against poverty and food insecurity with no end in sight.

As articulated in the Vision of African Agricultural Research and Development (SPAAR/FARA, 1999), “increasing agricultural production to achieve food security, higher incomes and sustainable economic growth while preserving the natural resource base remains the central challenge of African development.”

## 1.2 The CGIAR Context

The CGIAR is heavily committed to addressing agricultural productivity and natural resource management concerns in SSA. More than 40% of its total resources (US\$340 million in 2000) are devoted to problems of SSA. The importance of the CGIAR’s role in SSA has been underscored in two recent policy reviews. First, the 3<sup>rd</sup> CGIAR System Review, conducted in 1997-98, stressed the need for the CGIAR to give increased priority to SSA. It also recommended a more focussed and integrated research and development effort from the CGIAR and its partners, in SSA and elsewhere.

Second, the new vision and strategy of the CGIAR (adopted in 2000) has important implications for the System’s work in and on SSA.<sup>2</sup> The strategy calls for identifying new ways to tackle the problems of poverty that are amenable to agricultural research, while also continuing to contribute to sustainable productivity increases in global food supplies and improving the management of natural resources. Implementing this strategy will require more accurate targeting of people’s needs and assessing how CGIAR-supported research can meet these needs. Accordingly, future CGIAR research will be focused on improving the livelihoods of the rural and urban poor, through generating yield and productivity gains of staple food crops, livestock and fish and through sustainable resource management, as well as by customizing agricultural technologies to optimise income and employment generation in the rural sector.

The scientific, institutional and policy outputs generated by the CGIAR are, by themselves, insufficient to achieve the CGIAR’s vision and goal. This means that the CGIAR must work closely with other components of the development spectrum in determining its research priorities and in ensuring the dissemination of its research outputs. This is one of the seven planks of the new CGIAR strategy. Another plank calls for a high priority on addressing constraints in SSA and South Asia because these regions contain a high incidence of poverty. Others define new or modified ways of operating the CGIAR centres, including the adoption of a regional approach to research planning and greater use of “task forces” to address research issues. Hence, the CGIAR increasingly plays a catalytic role within the global agricultural research system.

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<sup>2</sup> The System’s vision is casted as ‘*a food secure world for all.*’ Its goal is to ‘*reduce poverty, hunger and malnutrition by sustainably increasing the productivity of resources in agriculture, forestry and fisheries.*’ The System’s redefined mission is: ‘*to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, livestock, forestry, fisheries, policy and natural resources management* (CGIAR, 2000).

Two other recent developments within the CGIAR have significant implications for the work of IITA. The first is the notable progress made in recent years in developing a CGIAR strategy and associated operating mode for SSA. The second is the change design and management effort that is underway in the CGIAR that has implications for the way CGIAR activities would be defined, financed and governed.

Regarding the first, the CGIAR centres active in SSA and representatives of African NARS (through SPAAR/FARA and the three sub-regional bodies co-ordinating research in SSA: ASARECA, CORAF and SACCAR) have agreed on the basic elements of a joint strategic action plan. The strategy is based on four pillars:

- germplasm and natural resource management
- technology dissemination and farmer empowerment
- policy research
- capacity building

In addition, the centres and their partners have agreed to integrate their research activities in SSA based on work currently undertaken in the two sub-regions (WCA and ESA). Programmatic integration is to be developed in the context of established sub-regional priorities and to be based upon partnership between NARS/SROs and the centres.

With respect to programmatic integration in WCA, the three major IARCs in the sub-region (ICRISAT, IITA and WARDA) have been exploring ways of expanding collaboration. The overall objective is to eventually achieve an integrated CGIAR research programme built on the specific needs of the sub-region. Much more needs to be done to realize this goal, but all parties are strongly committed to making it a reality.

Regarding the second, the Change Design and Management Team (CDMT) appointed by the CGIAR completed its report just before the final phase of this EPMR. The CDMT made two recommendations on CGIAR structure and governance, with direct relevance for CGIAR activities in SSA: financing of a set of Global Challenge Programmes (GCPs), and adoption of an evolutionary approach to restructuring the centres.

The GCPs would address issues of global significance (which could be regional in nature), involve a significant number of partners and would be managed independently (from the centres). They would provide an opportunity to the centres and their partners in SSA to develop broader programmes and initiatives than what can be carried out through the current centre projects. Adoption of an evolutionary approach to restructuring implies encouragement of the current integration effort going on between IITA, WARDA and ICRISAT in West and Central Africa.

### **1.3 Evolution of IITA**

IITA, one of the four IARCs (along with IRRI, CIMMYT and CIAT) that pre-dates the CGIAR, was established in 1967 in Ibadan, Nigeria as an autonomous, non-profit organization to address the challenge of alleviating hunger and reducing poverty in Africa.

IITA's initial mandate was quite broad, to increase the output and improve the quality of tropical food crops. The crop mandate covered practically every major food crop in SSA--cereals (rice, maize), legumes (cowpeas, soybean, pigeonpea, beans), roots and tubers (cassava, yams, sweet potatoes, aroids) and bananas, some for Africa and some on a global basis. Over the years, IITA's mandate has narrowed. According to the Draft Strategic Plan for 2001-2010, its crop improvement mandate now includes: cassava (for Africa), yam (global), soybean (for Africa), cowpea (global), maize (for WCA), and plantain and banana (global).

The humid and sub-humid tropics of Africa provide the agroecological focus of IITA's programmes. The Centre is responsible for and gives primary geographical emphasis to West and Central Africa, with certain activities related to its mandate crops recently established in Eastern and Southern Africa. Taken together, its crop and regional responsibilities take IITA scientists throughout SSA, with greatest concentration in WCA.

In terms of the broad logframe outputs used by the CGIAR, IITA's major focus has been and remains on sustainable production (41% of the total resources). Remaining resources are allocated to germplasm improvement (25%), enhancing NARS (20%), policy (10%) and germplasm collection (4%). From a geographic perspective, it invests about 75% of its resources on activities that primarily target WCA, 15% on ESA, and another 10% on matters of global relevance.

Today, IITA has 1,101 staff members: 106 are internationally recruited (IRS) and 995 nationally recruited (NRS). Forty-four percent of the IRS and 20% of the NRS are located in outreach sites. In addition to its headquarters location in Ibadan, staff are located in Lagos, Onne and Kano in Nigeria, Benin, Cameroon, Côte d'Ivoire, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zimbabwe. The Centre is organized into three Research Divisions supported by a Corporate Services Division. The Institute has had an annual budget of about US\$30 million over the last five years.

#### **1.4 IITA's Response to the 4<sup>th</sup> EPMP Recommendations**

The last EPMP was generally positive about IITA, noting the centre had substantially strengthened its programmes over the preceding five years. In response to the 4<sup>th</sup> EPMP, TAC encouraged the centre to strengthen its resource and crop management research and its capacity to conduct socio-economic research. Both of these areas were considered to be of critical importance to IITA at a time when it was being asked to take on ecoregional responsibilities within WCA.

The 5<sup>th</sup> EPMP Panel considered each of the 35 recommendations from the 4<sup>th</sup> EPMP, and evaluated the Centre's original, and most recent (December 2000), responses to them. The latter had the benefit of hindsight that comes with time. The Panel prepared brief commentaries to

evaluate the Centre's response, with a focus on the extent to which the Centre had adequately addressed those recommendations and, in some cases, whether the recommendation was no longer an issue (Annex V). The following is a brief summary of this evaluation.

Of the 35 recommendations from the 4<sup>th</sup> EPMR, 15 were directly related to research programmes and networks, while 20 involved organization, management, finance, and governance issues. The large majority of those related to research were addressed adequately or are no longer an issue. In a few cases, resource constraints and decisions about funding priorities limited compliance or the degree of compliance with the recommendations, but in hindsight the current Panel is comfortable with the Centre's follow-up actions. Only two recommendations regarding research programmes remain important issues, and the Panel has raised them once again in the current review. Suffice it to say that the 4<sup>th</sup> EPMR commended IITA for its high quality of science, especially in the plant health management and crop improvement programmes, but also called attention to shortcomings with respect to crop and resource management research and social and economic sciences.

Of the 20 recommendations of the 4<sup>th</sup> EPMR that addressed concerns about organization and management issues, including governance by the Board of Trustees (BoT), the current Panel believes that only six were adequately addressed or are no longer an issue. In contrast, twelve have not been addressed or are still a "work in progress" at the time of the 5<sup>th</sup> EPMR. Of particular concern to the current Panel were the recommendations related to Board procedures, research management, and priority setting mechanisms at the Institute level. Hence, these issues are also revisited in the current EPMR.

At the end of the day, the review team of the 5<sup>th</sup> EPMR strongly believes that IITA's mission is critically important to improving the quality of life in SSA. We trust that our efforts to provide a candid and honest assessment of programmes and management in this 5<sup>th</sup> EPMR will contribute to achieving this goal but note that two successive EPMR teams have now highlighted similar issues that have not yet been resolved. We believe that these residual issues, and several additional concerns identified in the present review, must be adequately addressed to ensure that the Institute can accomplish its mission.

## **1.5 Changes in Science, Technology, and the Operating Environment**

Identifying the most appropriate agenda for an applied research institution, such as IITA, requires consideration of recent advances in the basic sciences, new technologies, and the social, political, and economic environment that influence the research mission. Today, scientific innovation and discovery are proceeding more rapidly than at any time in human history. Breakthroughs in information technology have resulted in an exponential increase in computing power and the ability to organize and analyze massive amounts of data. Micro- and nano-scale electronics allow quantum leaps in the sensitivity of measurement and detection of elements and complex organic and inorganic molecules. A revolution in molecular biology is unlocking the secrets of the genetic code, giving rise to new research areas such as genomics and bioinformatics.

These advances provide researchers with new approaches and methods that were the stuff of science fiction only a few decades ago and allow research breakthroughs from one discipline to impact another more quickly than ever. This trend blurs the distinction between disciplines and highlights the need for greater emphasis on interdisciplinary collaboration.

Despite the explosion in new methods and the amount of data available to scientists, the ultimate payoff from investment in applied research still relies on synthesis and transformation of information into useful packages of knowledge. In fact, the need for the integrative sciences, such as ecology and the behavioural sciences, is greater than ever given the power of data acquisition coupled with increased capacity to perform dynamic analyses and simulations of complex systems.

But while the potential benefits from the expanding universe of science are astounding, they do not come cheaply — especially at the frontiers of knowledge. Moreover, funding for crop and natural resource management research has been decreasing at a time when the challenges of food security and natural resource conservation have never been greater. Hence, the challenge for research institutions such as IITA and the NARS is to invest their limited resources wisely.

Prioritization and implementation of IITA's research agenda also depends on the political, social, and economic environment, both within the mandate region and globally. For example, the new scientific tools mentioned above have resulted in greater valuation of intellectual property (IP) related to plant and animal genes and organisms, which in turn increases concerns about IP ownership. Such IP issues now demand the attention of public sector research institutions to ensure the free flow of crop germplasm and information — especially for the benefit of the rural and urban poor in developing countries.

Liberalization of global trade offers both opportunities and challenges to agriculture in SSA as new markets open and competition from other regions intensifies. There is a higher risk of spreading insect pests as a result of greater movement of commodities across national borders and continents. Finally, concerns about anthropogenic effects on the global environment are gaining the attention of both scientists and policy-makers, which may have potential implications for research on food production systems and natural resource conservation.

In contrast to these dynamic changes in science and commerce, economic development and food security remain critical challenges to the people of SSA. Political instability and inappropriate policies have combined to limit economic growth that the region continues to be the most intense locus of poverty in the developing world. Without a major increase in the rate of economic development, this situation will not change in the foreseeable future. Because 65% of the labour force obtain most of their livelihood from agriculture, improvements in agricultural productivity and sustainable management of the resources on which agriculture depends are pivotal components of the development engine. Indeed, the opportunity to improve this engine of growth at the grass-roots level for people in SSA provides the primary motivation for most scientists who work at IITA and in the regional NARS, as well as for the members of the EPMR review team.

Finally, the Panel has noted an increasing spirit of collaboration amongst the various partners contributing to the goals of poverty alleviation, food security, and natural resource conservation at international, regional, national, and local levels. We believe this trend provides tremendous opportunities for IITA to play a leadership role in helping to strengthen these partnerships and to set the research agenda.

## **CHAPTER 2 - STRATEGIC PLANNING: PRIORITIZATION, PROGRAMME FOCUS AND STRUCTURE**

Our review of IITA's strategy is based on the most recent draft of the document "Strategic Plan for 2001-2010". Although this document was approved by the Executive Committee of the Board at its 29 October 2000 meeting, the Committee also decided that the plan should be kept as a draft in order to incorporate changes reflecting the effect of decisions taken on future developments in the CGIAR during the Mid-Term Meeting of May 2001. Hence, the Strategy remains a "work in progress" and the EPMR Panel is pleased with the opportunity to provide substantive comments that may influence the final outcome. Despite its draft status, the Panel notes that several key themes from the Strategy have already been incorporated into the 2002-2004 MTP.

The Panel also recognizes that the Centre's strategic planning is coincident with strategic planning initiatives within the CGIAR System. Given the uncertainty about the outcome of this planning at the Systemwide and regional levels, our review will focus on IITA's mission and role as a premier international research institution in WCA, a region that includes significant programme activities of WARDA and ICRISAT, and will seek to highlight those areas in which IITA can play a leadership role because it has the critical mass and comparative advantage to do so.

### **2.1 IITA's Mission and Objectives**

The draft Strategy reaffirms IITA's mission to "enhance food security, income, and well being of resource-poor people primarily in the humid and sub-humid tropics of SSA by conducting research and related activities to increase agricultural production, improve food systems, and manage natural resources in a sustainable manner, in partnership with national and international stakeholders." To achieve its mission, IITA generates scientific knowledge, provides training and information, and participates in technology transfer with a wide range of partners. The principle objectives are to:

- develop and improve systems for the effective management and conservation of natural resources for sustaining agriculture;
- increase agricultural productivity and enhance commercialization opportunities for agricultural products to ensure improved food security, raised farmer incomes, and to contribute to the development of an effective agro-industrial sector; and to
- help strengthen national and regional research systems.

The mission and objectives are consistent with the strategic directions of the CGIAR System, which has a strong focus on the alleviation of poverty and ensuring food security for both urban and rural poor (Section 1.2). The SSA region is characterized by the most intense poverty and undernourishment in the developing world, and 65% of the labour force is presently employed in the agricultural sector. Moreover, population growth is expected to drive food

demand at an annual growth rate of 3.3%, which is well above the projected rate of increase in food production. Improving agricultural productivity and profitability in a sustainable fashion are crucial to both economic growth and better access to food, especially for low-income households. Therefore, the Panel supports the mission and objectives, as presented in the draft Strategy, and believes the Centre's mandate remains valid in terms of geographic focus and mandate crops. In the following sections, we comment on the Institute's research strategy, priorities, workplan and the organizational structure to implement them.

## **2.2 Priorities and Programme Focus**

### **2.2.1 Prioritization Process**

The draft 2001-2010 Strategy includes new approaches for focusing, implementing, and organizing the research agenda. A dynamic “market-oriented” process is proposed for identifying research within each of four major agroecological zones (AEZs). Concurrently, IITA has made efforts to engage the sub-regional organizations (SROs)—CORAF/WECARD, ASARECA, and SACCAR—in the planning exercise. These groups established research priorities by crop species and natural resource management objectives within the following geographic regions: West African Sahelian zone, Coastal West Africa, Central Africa, East Africa and the Great Lakes, and Southern Africa.

The draft Strategy proposes increased emphasis on a “market-orientation” of the research agenda to be developed by AEZ research teams. The EPMR Panel understands market orientation to have two dimensions. The first is a commercial dimension that would emphasize the identification of opportunities for commercialization of agricultural products to increase end-use value of IITA's mandate crops. Market research would identify these opportunities, with special attention given to local processing capabilities and the needs of women entrepreneurs. The second dimension would respond to crop production constraints and natural resource management concerns identified by farmer groups, NARS, NGOs, and the private sector. Their concerns would be identified by the AEZ teams in an iterative process involving dialogue and participatory research. Taken together, the Panel sees a “demand-driven” research agenda based on farmers' needs, market demand, and the needs of NARS partners.

The Panel supports this approach for identifying constraints and prioritizing research within an AEZ framework. We believe it will provide an effective process for identifying research targets and for locating the research in the most relevant extrapolation domain. Many of the West African NARS use a similar AEZ framework to describe their production domains. We applaud the active engagement of NARS and the SROs in the problem identification process and note that the demand-driven research focus will foster an ongoing dialogue with a wide range of stakeholders to refine and update the research agenda as appropriate.

To successfully implement this prioritization process, however, the Panel sees three major challenges. *First*, the Panel believes that detailed understanding and assessment of the impact from IITA's research programmes and partnerships in the past are a prerequisite for making effective choices about future research investments. The current process of priority

setting shows little evidence of being based on such hard-headed analysis. For example, the draft Strategy document cites the increase in total production of the major food crops, such as cassava and maize, as evidence of impact from IITA's research and technology transfer. It is argued that the release of improved varieties and biological control agents for major pests that were developed by IITA and its partners during the past 20 years are coincident with the increase in total food production. In fact, yield levels of the major food crops increased at an annual rate of only 0.2% to 0.7% during the past 10 years in SSA (Table 2.1), far below the rate of population growth. The increase in food production resulted mostly from increases in cropped area and cropping intensity, but the relative contribution from actual expansion of cropped area versus increased cropping intensity on existing cropland is not well documented. Our discussion with NARO leaders indicated that they too do not have hard data on this issue. Lack of such information limits the ability to prioritize research effectively for two reasons; first, the primary constraints and their solutions are likely to require different approaches depending on whether crop production is expanding into new areas or intensifying on existing croplands; second, knowing the contribution to production growth and estimates of future trends from area expansion versus intensification would improve resource allocation decisions among research objectives within and across AEZs based on the relative importance of these two processes.

**Table 2.1 Rate of Change in Area, Yield, and Production of IITA's Mandate Crops in sub-Saharan Africa, 1989-1999**

Crop	Area	Yield	Production
Cassava	2.6	0.7	3.3
Maize	0.8	0.2	1.0
Yam	7.2	0.4	7.6
Cowpea	7.6	-1.1	6.5
Soybean	-0.1	4.8	4.7
Plantain	1.9	0.0	2.0

Based on three-year average for 1988-1990 and 1998-2000. FAO database.

While the Panel strongly believes that IITA's research products have made a positive impact on food production and food security, aggregate data suggest that this impact has resulted from protection of yield rather than yield increase *per se*. Indeed, it is possible that average farm yields of the mandate crops would have shown no increase at all or even a decline without the benefit of IITA's research on crop improvement and biological control of major pests. Although yield protection is less satisfying than a rapid advance in yield levels, we consider it a notable achievement if yields have been maintained in the face of widespread trends of decreasing soil fertility, little or no fertilizer use, and increasing pest pressure as cropping systems intensify in the humid and sub-humid tropics of Africa.

As noted in the Strategy, future expansion of cropped area will increasingly occur on marginal land or remnant forest zones while a shift towards shorter fallow periods and even continuous cropping is occurring on existing cropland. Protection against degradation of natural resources and achieving food security will therefore increasingly depend on sustainable

intensification of production on existing cropland. At issue is why existing technologies known to increase yields substantially have not been widely adopted by farmers in these regions where cropping intensity is increasing and new crops such as maize are expanding in production area. Clearly political and economic instability have been significant limiting factors but these constraints are not likely to disappear in the next 10 years. How then does IITA's strategy propose to surmount these constraints and how will the prioritization process help focus research on developing technologies that will be adopted by farmers to achieve increased yields and profit while conserving natural resources?

Quantitative analysis of the relative contributions of IITA's research to yield improvement, expansion of cropped area, increased cropping intensity, and enhanced soil quality, is needed to underpin strategic planning. Providing research leadership to obtain this understanding is an area in which IITA has a comparative advantage, and the Panel has identified the need for greater investment in this area (Sections 3.4.4 and 3.6).

*A second challenge* confronting implementation of the draft Strategy is the need to rationalize IITA's research agenda identified by AEZ with the research needs identified by NARS partners organized in the SROs. The SROs represent geopolitical groupings that are not congruent with the AEZ boundaries. For example, strategic planning of programme priorities with CORAF/WECARD was conducted within each of three zones: the West African Sahelian zone, the West African Coastal Zone, and the Central African zone. Each of these zones comprises a set of countries, but most of the countries within a zone contain two or three of the AEZs. Nigeria, Ghana, Benin, Togo, and Côte d'Ivoire are grouped in the West African Coastal zone and yet each country includes significant land area that would be classified within the dry and moist savannah AEZs, and the humid forest AEZ.

Data on crop production and socio-economic parameters are available only within geopolitical units at the country and sometimes district or state levels and not by AEZ. Ultimately these data need to be available in geo-referenced format to improve the research prioritization process, for greater efficiency in targeting research and technology transfer to specific regions within the AEZs, and for impact assessment. While the Panel commends IITA on existing efforts to develop such a geo-referenced database for both biophysical and socio-economic data within the AEZ framework, we urge a more vigorous pursuit of this objective. At the same time we encourage a tight focus on the most relevant data to support programme objectives to avoid over-investment of time and resources in database development.

Other related issues concern the actual parameters used to define AEZ boundaries and use of the benchmark area approach for implementing research programmes within an AEZ. The present delineation framework does not employ similar biophysical criteria for all AEZs. The savannah and humid forest AEZs are determined by elevation and length of growing season, the latter a proxy for moisture regime, while the mid-altitude AEZ is classified by elevation alone and contains a wide range of moisture regimes. In fact, we question the usefulness of the AEZ concept applied to the mid-altitude zone because of such wide variation in temperature and moisture regime over small distances. While the Panel believes the AEZ framework is sound for the moist and dry savannahs and the humid forest zones, we would like to see a more relevant biophysical framework for their delineation. Such a framework need not require complex

analysis of multiple variables. A straightforward focus on water balance in relation to major cropping system assemblages should suffice.

*A third challenge* is the need to make hard choices among the numerous researches needs both within each AEZ and across AEZs. The draft Strategy identifies the Research Programme and Executive Committee (RPEC), composed of AEZ Team Leaders, Division Directors, and senior administrators as the unit that will make these choices by considering proposed research activities in relation to the scientific and other resources available for implementation. An annual work-planning meeting is used to allow discussion and input to this process by the scientific staff. In addition, a scoring system has been proposed to rank proposed activities and research proposals by a set of seven criteria. The Panel examined these criteria and finds them lacking: they do not provide an adequate framework for rational, transparent and effective priority setting. In fact, it is not clear what the Centre's priorities are, and our review of IITA's research programmes and projects (Sections 3.2-3.5) identifies many areas requiring prioritization of research objectives.

A clear and more structured process for setting priorities is of fundamental importance to efficient management of research programmes, from higher-level decisions about relative investment across AEZs and projects to the finer detail of choosing among specific breeding objectives or biological control methods for allocation of resources. The vital importance of a sound framework for priority setting also was emphasised in the 4<sup>th</sup> EPMR, which made a recommendation to "further develop a priority-setting methodology, including ex-ante impact assessment, irrespective of funding source". The current Panel reiterates this point with greater resolve:

**The Panel recommends that IITA place immediate emphasis on establishing a sound methodology for prioritizing their research agenda.**

Such a framework must consider the potential contribution of the research to achieving the Centre's mission, its contribution to knowledge that contributes to international public goods, and its comparative advantage to conduct the research. The Panel sees a tremendous opportunity to underpin this priority-setting process with an improved capacity in geo-spatial analysis (Section 3.6) that focuses on the driving forces of poverty, food security, and natural resource degradation.

### **2.2.2 Shifts in Programme Focus**

The draft Strategy highlights several prominent shifts in programme emphasis and new approaches in conducting research. In general, the Panel applauds IITA for these initiatives and sees them as evidence of its flexibility and responsiveness to changing conditions in SSA and the CGIAR System. We also believe that several issues warrant attention as these plans are implemented. Specific recommendations related to some of these issues appear in other chapters of the report.

**Benchmark areas.** IITA has adopted the benchmark approach to help rationalize the difficult task of conducting research within an AEZ framework across multiple jurisdictions

containing a large number of biophysical and socio-economic associations. The approach is central to plans for operating EPHTA, the systemwide ecoregional programme that developed from an earlier CGIAR initiative, and is increasingly the focus of work carried out by scientists in the RCMD. The Panel recognizes the benchmark approach as having several operational advantages:

- to provide locations where on-farm and on-station field research can be conducted in representative environments from which relevant—that is, having likely impact and being accepted by NARS—technologies can be identified and tested;
- to conduct field research that provides understanding of critical factor interactions that govern technology performance and acceptance;
- as a focus for participatory development, testing, validation, and monitoring of technologies;
- to provide a gradient of resource use intensification that allows for an understanding of underlying driving forces and farmer/farm community responses to them. Such an understanding provides the strategic backdrop to the development of technologies and processes that fit specific farmer circumstances and at the same time allow for the identification of key criteria for extrapolation to similar areas in the AEZ outside the benchmark.

While the Panel generally supports this approach to enable collaborative research in a focused manner within much larger AEZs, we are less certain of using the benchmark area itself as an experimental ecological unit for broader generalization of fundamental understanding and extrapolation of technologies to other regions. A research and business plan, including a timeline for outputs and impact, are needed to show how this work will move from the descriptive phase to technology development and transfer in an efficient and cost-effective manner. Further discussion of this topic is provided in Sections 3.4.2 and 3.4.5.

***Market orientation.*** IITA proposes a more aggressive shift away from a supply-driven perspective for technology development to a demand-driven approach based on identifying stakeholders' interests and needs, especially those of farmers and entrepreneurs. This shift requires a consultation process with host country institutions, the private sector, farmers, traders and consumers to ensure that technologies meet local needs within specific agroecological and socio-economic extrapolation domains. The Panel notes that this emphasis encompasses the entire production-consumption continuum, and therefore requires a subsector (commodity) analysis to identify opportunities for adoption of post harvest technologies, potential bottlenecks in existing marketing channels, and anticipation of new demand pathways. Market research is clearly needed to fully understand this continuum. At issue is who should do it.

The 1996 CCER on Improving Postharvest Systems concluded that marketing issues must be addressed but argued that IITA may not have a comparative advantage to do so. The present Panel concurs with this argument because marketing research is typically location specific (see Section 3.5). While we strongly endorse the demand-driven approach to research prioritization, we believe that IITA should subcontract much of the market research work to local institutions and other researchers, in both the private sector and NARS, to obtain the required information about market opportunities and bottlenecks. Having said this, the Panel believes

IITA must understand and anticipate the changing nature of demand for its mandate crops, and use this information to guide research.

***Intensification of cropping systems.*** The draft Strategy places considerable emphasis on developing and extending technologies that support sustainable intensification of cropping systems, especially in the dry and moist savannah AEZs. Integration of livestock in these cropping systems also features prominently in the Strategy to increase and diversify income sources and to promote recycling of nutrients. IITA provides three reasons for this emphasis: first, large areas in West Africa have already made the transition from crop-fallow to continuous cropping systems, (increasing population pressure dictates that this trend will continue); second, use of inputs to maintain soil fertility and improved germplasm have not been widely adopted, while disease outbreaks and increased pest pressure, especially from weeds and parasites like *Striga*, are often associated with intensification; third, germplasm alone is not likely to achieve the required rates of improvements in food production, income, and natural resource conservation.

The Panel supports IITA's plans for greater research emphasis on the intensification process in the WCA region. We note, however, that data on area under intensified cropping and rate of area expansion are not readily available and would urge a concerted effort to obtain them to more efficiently direct research efforts towards "intensification hot spots". We also encourage a tight focus on strategic issues of widespread importance. A key challenge for IITA is to identify innovative ways to make progress on the sustainable intensification issue. Many of the large development projects, funded by the major international finance institutions in the past 30 years, have also promoted efficient use of inputs in food crop systems of WCA. Hence, collaboration and linkages with the World Bank, IFAD, and IFDC projects and NARS policy agencies will be important components of this work.

***Increased emphasis on policy research.*** The draft Strategy proposes a significant increase in research on policy issues, from 6% of the research budget to 10%. The need to understand and help formulate policies that foster sustainable intensification of cropping systems and integration with livestock are given as justification for this shift. The Panel endorses the increased emphasis but urges a broader focus on strengthening research capacity in socio-economics more broadly—not just on policy. (Section 3.5).

***Biophysical interactions at different scales.*** The study of ecosystem components and their interactions at different spatial and temporal scales is an extremely interesting and challenging research area. It requires a critical mass of expertise to be successful. While the Panel recognizes the exciting intellectual content and potential impact of this research area, it does not believe that IITA has a comparative advantage to address it. Given the amount of resources required, and the relatively high risk of the research, in terms of potential impact, we do not believe it is a high priority.

## **2.3 Building NARS Capacity**

### **2.3.1 Research Development Continuum**

Investors in IITA's programmes expect measurable progress towards the Institute's mission of poverty alleviation, achieving food security, and natural resource conservation. But IITA cannot accomplish these goals by itself and must rely in large part on effective partnerships and technology transfer by NARS at the farm level. Based on data provided to the Panel and on our discussions with NARS leaders, however, it is clear that NARS capacity to implement research and technology transfer has eroded significantly during the past 10 years. Hence, IITA has a major challenge to demonstrate impact, especially at national and regional levels. While there is an understandable temptation to plug every gap in the agricultural development process, including extension at the farm level, major technology transfer projects are neither feasible, given resource constraints, nor desirable given IITA's primary role as a research centre devoted to producing international public goods. It is therefore imperative that IITA develop an appropriate strategy for positioning itself properly on the research-development continuum.

Although the primary objectives of IITA programmes must continue to focus on strategic research, the Panel endorses involvement in technology transfer activities under certain conditions. First, IITA should identify its comparative advantage in making contributions to technology transfer, development, and disaster relief projects. Clearly, utilization of improved crop germplasm and IPM in cropping systems designed to take advantage of them are areas in which IITA has strong research programmes and could easily contribute, in partnerships with NAROs and NGOs, in technology transfer. In addition, such involvement could also provide opportunities to study the acceptability and performance of their improved technologies, which provides feedback to the researchers and helps guide future research investments. On the other hand, non-selective participation in development projects risks diverting focus and resources away from IITA's primary mission of conducting strategic research.

The Panel does see opportunities for greater linkages and involvement as technical advisors to major technology transfer projects funded by international finance institutions such as the IBRD, the ADB, and IFAD. This is consistent with the CGIAR's new emphasis of stronger partnerships with development organizations and institutions. The Panel notes IITA has already initiated successful linkages with major IFAD projects in Ghana and Nigeria and urges a more proactive stance in establishing relationships with these agencies. IITA has much to offer, not only in terms of technical advice on project planning and implementation, but also with regard to technology options for extension to farmers and commercialization by rural entrepreneurs.

### **2.3.2 New Approaches for Working with NARS**

A number of external factors are already having, and will continue to have, a major effect on IITA and its partnerships with NARS. One change is the emergence of the SROs, consisting of representatives from the individual African NARS for West and Central Africa (CORAF/WECARD) and East and Southern Africa (ASARECA and SACCAR), as organizations that can provide co-ordination to prioritization and planning of agricultural research agenda in their respective regions. The Panel applauds IITA for its active engagement of SROs in developing its draft Strategy.

Change in the CGIAR System itself is another factor that will affect IITA and its partners. Current discussions are in progress concerning regional research approaches, global challenge programmes, and organizational changes to support them. Involvement of the SROs in strategic planning and research co-ordination will become increasingly important as IITA and the other CGIAR Centres explore opportunities to increase research efficiency by sharing resources and integrating programmes. The Panel notes that these issues are the subject of two reports, one on “Designing and Managing Change in the CGIAR” and another on “Regional Approach to Research for the CGIAR and its Partners”, both to be presented at MTM 2001. The Panel strongly supports the move towards broader and more formal integration of support services, activities, programmes, and facilities in WCA and has received feedback from NARO scientists and Ministry of Agriculture officials in support of such integration. Because IITA is the premier international centre in the region, we believe there are exciting opportunities to enhance IITA’s impact.

The AEZ approach being adopted by IITA also provides a useful framework for regional planning and co-ordination of research with NARS partners. Many of the NAROs in West Africa already use a similar classification scheme for agroecosystems in their countries, and for organizing research programmes. With a bit of refinement based on more robust delineation criteria and an appropriate geo-spatial database, the AEZ framework can provide an effective approach to facilitate and support regional research planning and partnerships.

Finally, IITA’s strategy for building NARS capacity must deal with the fact that national funding for agricultural research and extension programmes has decreased significantly during the past five years in most countries of WCA. A reversal of this trend is not likely to occur in the foreseeable future. In contrast, the Panel was impressed with the scientific staff found in the NAROs visited. Most have good representation of senior scientists in the key disciplines such as plant genetics and breeding, crop and soil science, entomology, and plant pathology. IITA recognizes this situation in its draft Strategy and proposes to work with a broader range of stakeholders, in addition to the NAROs, to implement its programmes that require collaboration at the local level. In the past five years, it is clear that IITA has moved effectively in this direction to work with NGOs, small-scale entrepreneurs, farmer groups, and the private sector (Section 4.3). The Panel commends this response and believes that collaboration with a broader array of partners will continue to be an important component of its strategy.

Lack of operating resources in the NAROs has other implications for IITA with regard to training, networks, and information dissemination. The draft Strategy refers to training and information dissemination as fundamental components of its mission but does not provide specific plans for either. The need to encourage the participation of women in its training activities and the strengthening of electronic publishing capabilities also are mentioned, but without specific objectives. While information dissemination and training are highly valued by the NARS, it is difficult to attract external funding for these activities. With constrained human and financial resources, especially from the unrestricted core budget, it is crucial for the Centre to develop explicit strategies for both training and information dissemination that take full advantage of the rapid advances in information and communication technologies.

The Panel's visits with NARS administrators and scientists in the WCA region indicated strong demand for training and access to information from IITA. At the same time, we also noted that the largest constraint to increased NARS research capacity is the lack of operating funds rather than the need for more scientific staff. Accordingly, we believe that IITA should focus resources allocated to training on providing mid-career scientists and professors in the NAROs and universities the opportunity to refresh their skills and expertise (Section 3.7.1). This in turn would help improve their capabilities as IITA collaborators and increase their competitiveness for funding from both within the NARS and with international funding agencies.

The development and worldwide distribution of educational materials via electronic media deserves concerted attention in IITA's strategy. While many NARS institutions presently do not have access to the Internet, this is likely to change rapidly. The Panel applauds IITA for investing in internet linkages with NARO scientists who participate in several of IITA's network programmes, and we urge more proactive planning for use of electronic information technology to support training and information dissemination.

The Panel also expects the role of networks to increase in importance in IITA's overall programme. Their function today already extends beyond regional testing of germplasm and other production technologies; they also provide a forum for priority setting, sharing of tasks and extrapolation of technologies to where they can be most effectively used. The Panel commends IITA for making full use of this approach, particularly in the areas of crop improvement and IPM. Such networks will play a crucial role as the national and international research institutions operating in a given sub-region integrate their operations around common focal points of interest. We also expect that further gains in sub-regional collaboration will be possible by making full use of electronic communication technologies, especially in networks, and commend IITA for taking initial steps in this direction.

## **2.4 From Strategy to Structure: A Work in Progress**

***Present management structure.*** The existing research management structure is best described as a research Division-based structure with an emerging contribution of AEZ Teams to the research planning and implementation process. It should be noted that each of the three Divisions are relatively heterogeneous, containing scientists from a relatively wide range of disciplines, compared to academic departments at universities. Operating budgets are allocated to individual scientists, who reside in Divisions and are line-managed by the Division Director. A portion of an individual scientist's time is allocated to one or more (up to four) projects. At present, there are 14 projects in the 2002-2004 MTP, down from 17 in the previous MTP, which represents a continuing process of consolidation (Annex VI). Although there are Project Coordinators for each project, there are no committed budgets or staff under their supervision. Existing projects appear to be little more than an envelope to house research activities for reporting purposes.

***IITA's proposed plans for a new structure.*** Because IITA's draft strategy proposes an AEZ framework for planning and implementing research, a new research management structure is under discussion within the Institute. A draft proposal for a new management structure is on

the agenda of the May 2001 Board of Trustees meeting. The Panel's discussion of research management at IITA is therefore based upon this proposal.

The key players in the proposed management scheme are Division Directors, AEZ Team Leaders, Project Co-ordinators, and the Research Programme and Executive Committee (RPEC). The RPEC will have eleven members: the DG, who serves as Chair, the DDG, the three Divisional Directors, the four AEZ Team Leaders, the Director of Corporate Services, and a representative of the External Liaison Office.

The RPEC will play a pivotal role in managing the proposed research structure. IITA's research agenda will be comprised of the research priorities of the four AEZs balanced against the human and other resources available to implement this agenda. The research agenda within each AEZ is developed by an AEZ team, with assistance from a stakeholder committee to identify highest priorities. The priority researchable issues will be assigned to one or more of the 14 projects by RPEC. In so doing, RPEC will strive to achieve an overall balance in the research portfolio that is consistent with human and funding resources, and with the Institute's mission and objectives. A ranking system with specific criteria is proposed to help RPEC prioritize resource allocation among competing project activities and AEZ programmes to achieve this balance. In addition, RPEC will attempt to strike a balance in the overall portfolio amongst strategic and applied research. RPEC also is responsible for systematically reviewing each research project once every 18 months and making changes accordingly to ensure project relevance and quality. Approval of new projects or termination of existing projects is also the responsibility of RPEC.

Each scientist is proposed to be responsible to an AEZ Team Leader for work that contributes to the AEZ agenda and to their Division Director for the strategic research they undertake. Project Co-ordinators and individual scientists will have input to the planning process, in particular during the annual work planning week when the allocation of scientist time across projects and AEZ programmes will be agreed to with AEZ Team Leaders and Division Directors.

***Preferred Scenario: Structure that supports strategy.*** In making our comments about the proposed management scheme, the Panel recognizes that an appropriate structure is a necessary, but not a sufficient condition for implementing a high quality research programme. Ultimately, the quality of the scientists and their commitment to effective collaboration is the basis for a successful research organization. Having said this, the choice of a particular reporting and planning structure should reinforce the capacity for multidisciplinary research, facilitate research focus, and foster a free marketplace of ideas. The Panel believes the following issues must be addressed to successfully implement IITA's research agenda:

- Line authority for planning and reporting should reinforce the AEZ programme — research project structure in which AEZ teams have responsibility for planning the research agenda and projects implement the agreed upon activities. In our view, the proposed structure does not provide this reinforcement: Budgets go through Divisions and Project Co-ordinators lack authority and committed budgets.
- Strong interdisciplinary collaboration, including both biophysical and socio-economic scientists, is required to understand and address the root causes of poverty, food insecurity,

and natural resource degradation. Research projects provide an effective vehicle for strategic planning and implementation of multidisciplinary research using a systems-based approach. Without some authority for planning and implementation within a project, however, the benefits of project-based management cannot be achieved.

- Effective projects would be accountable to deliver research outputs that address well-defined objectives identified by the AEZ teams. Projects should have either a defined cropping system focus or crosscutting function as a theme. Most projects would have specific activities in two or more AEZ programmes although some projects could be centred almost entirely in one AEZ.
- AEZs provide an effective framework for prioritizing research and aggregating a portfolio of research project activities into a cohesive programme that can address the highest priority issues. AEZ teams, comprised of individual scientists assigned to projects with activities within the AEZ programme, are in the best position to identify research issues and prioritize among them, in collaboration with stakeholders.
- The number of projects should be kept to a minimum. The Panel believes a number of the existing 14 projects could be merged. For example, we see no reason for one project on “Improving Maize-Grain Legume Systems” and another on “Integrated Management of Maize Pests”.

While the Panel will not make a formal recommendation about research management structure, we have significant concerns about the proposed plans. In particular, we believe that budgeting should flow directly to output-driven dimensions of the structure, either AEZs or projects, and not to the input dimension, which are Divisions. The Panel also notes that the structure has three dimensions (Divisions, AEZ Teams, and Projects) but line-management accountability in only two; co-ordinators do not have authority over budgets or staff in their projects and yet must annually report on goals, activities, outputs, and milestones. It is difficult for the Panel to envisage what would motivate a scientist to serve as a Project Co-ordinator.

The Panel’s preferred scenario would be an AEZ by Project structure with ten or fewer projects. Budgets would be allocated to AEZs, and the AEZ teams, under leadership of the Team Leader, would allocate this budget to projects. A project’s budget represents the sum of resource allocations from all AEZs in which it has funded activities. A portion of an individual scientist’s time would be allocated to a given project, and the Project Co-ordinator would assign a budget in accordance with the resources required to achieve the specified outputs. Individual scientists would be responsible to the Project Co-ordinator for their contributions to project objectives, and Project Co-ordinators would be responsible to the AEZ Team Leader for contributions to the AEZ agenda.

To ensure scientific quality, we envisage a Principal Scientist in each of four discipline areas - plant genetics, plant health, crop or soil science, and the social sciences - who would have an administrative responsibility to evaluate the scientific quality and disciplinary impact of research outputs of individual scientists. Each individual scientist would be assigned to one of four ‘discipline clusters’; each led by a Principal Scientist. Annual evaluation of an individual scientist would include input from the AEZ Team Leader(s), the Project Co-ordinator(s), and the Principal Scientist. Individual scientists would provide input to the review of their Project Co-

ordinators and AEZ Team Leaders, and Project Co-ordinators would provide input to the review of AEZ Team Leaders. Principal Scientists and AEZ Team Leaders would be members of RPEC and would report to the DDG for Research (DDG-R, see below). The DDG-R would co-ordinate the annual review process for individual scientists by summarizing the input from the AEZ Team Leaders, Project Co-ordinators, and Principal Scientists. Scientists who perform mostly service functions or who work in more basic research areas could report to the Principal Scientist closest to their discipline or to the DDG-R.

Regardless of the research management structure that is eventually set up, the EPMR Panel sees an urgent need for a DDG-R to oversee and be accountable for implementing the research programme and evaluation of scientists, AEZ Team Leaders, and Project Co-ordinators. This position would also serve as the RPEC Chair, thus providing the DG with more time to devote to longer-term strategic planning to ensure relevant programmes and effective relationships with host countries, NARS, and donors. We note that the 4<sup>th</sup> EPMR recommended the appointment of a DDG-R. Given the impending transition to a new DG, we believe the need for a DDG-R is even stronger today. Therefore:

**The Panel recommends immediate recruitment of a DDG-R with responsibility to guide and manage IITA's research programme, evaluate its quality and relevance, and be accountable.**

## 2.5 Summary

IITA is on the verge of a new era regarding leadership and research. The CGIAR System, in which it is embedded, is considering major changes in its own organization and conduct of business. The EPMR Panel has tried to understand these changes and believes they present exciting opportunities for IITA to exert its leadership as the premier international agricultural research organization in SSA. To take advantage of these opportunities, IITA must have a clear vision of its fundamental research priorities, which provide the guiding beacon for elaborating its specific research plans and for directing its interactions with partners.

While the Panel sees a number of excellent research components and new directions in the proposed Strategy, we were not able to identify the Institute's essential priorities or a transparent method for setting them. There are too many needs and too many potential partners to move forward in an aggressive fashion without a clear set of priorities. To address this issue, the Panel makes two recommendations: (1) that the Institute take immediate action to establish a sound methodology for setting priorities; and (2) that it hire a DDG for Research to guide and manage the research agenda—and be accountable for its performance. We strongly believe these actions are crucial to maintaining IITA's premier status and to ensure that it achieves its mission.

## CHAPTER 3 - RESEARCH PROGRAMMES

### 3.1 Research Quality Assurance

#### 3.1.1 Internal Review Processes

The Centre employs several mechanisms to ensure that consistently good quality science is practised at IITA. These include:

- RPEC project evaluation
- annual work planning week
- annual staff performance appraisals
- monitoring and oversight by the Programme Committee of the Board
- centre-commissioned external reviews (CCERs).

RPEC meets quarterly in Ibadan or at one of the stations for three days, with two full days devoted to a review of existing projects and approval of new projects. Each on-going project is systematically reviewed once every 18 months. Individuals are called on to make presentations covering both accomplishments to-date and future plans for their research projects. Minutes of the research reviews are circulated to senior scientists and to the Board. It is understood that at the present time the committee works in a harmonious way. The Panel found it somewhat difficult to assess the effectiveness of RPEC's monitoring of scientific quality of projects because projects do not have committed budgets and project co-ordinators do not have line authority over staff who have time allocated to their projects.

Once a year, usually in November, all IITA IRS and postdocs come to Ibadan to participate in week-long research planning and evaluation meetings. These meetings are organized at the project level and discussions focus on the previous year's achievements with respect to individual project logframe outputs and milestones, and planning and development of the next MTP. The core budget allocation process employed during the planning week was not well explained to the Panel, and is reported to lack transparency to many members of staff as well. This seems to reflect a lack of clarity in the prioritisation and planning process, which is the core of the planning week. As such, the Panel found it difficult to make a judgement about the effectiveness of the planning week with respect to Centre evaluation and planning. Nevertheless, the Panel believes that most scientists find this week's activity useful from a number of other perspectives and this was confirmed by results from the EPMR- administered IITA staff survey. To improve the quality of this evaluation and planning exercise, the Panel sees value in bringing in outside peers / advisors in relevant disciplines as consultants during those evaluation and planning meetings.

To ensure high staff performance, the Centre has adopted an interactive performance appraisal process, covering both scientists and non-research staff. The procedures for evaluating the performance of scientists are fairly detailed and well defined generally. Scientists are appraised based on three broad criteria, weighted appropriately: research content and output;

transfer and communication of research results; and personal effectiveness. Currently, the performance evaluation exercise involves the DG, the DDG, the relevant Division Director and relevant Project Co-ordinator (PC). The draft MTP comments that, in the future, this would also involve the AEZ Co-ordinator. The Panel believes it would be more straightforward and more appropriate for fewer supervisors to be directly involved in this process, e.g., the PC, AEZ Co-ordinator and DDG (R).

Ultimately, the Board of Trustees, through its Programme Committee, is responsible for ensuring the quality of science at the Centre. The effectiveness of this committee in discharging its functions is discussed in a later section (see Section 5.1.6). The Panel believes this mechanism could and should be strengthened and has made recommendations accordingly (Section 5.1.9).

IITA has invested a considerable amount of effort and resources in centre- commissioned external reviews (CCER) (see next section).

### **3.1.2 Use of CCERs for Evaluation of Research Programme Quality, Productivity and Relevance**

#### **3.1.2.1 Context and background**

CCERs were introduced to the CGIAR to improve the quality and consistency of EPMRs in 1995, addressing their second term of reference (ToR), namely the relevance and quality of science at the Centre. It was argued that there is such a wide range and richness of science conducted in the Centres, that EPMRs were not always able to cover the full extent in the short time frame allotted. While CCERs are also commissioned to address other terms of reference, (such as the one on Management Administration and Operations conducted in IITA in 1998), this section is concerned with their role in evaluating the research programme.

CCERs were therefore seen as a possible way in which Centres might be able to audit the relevance and science for their own purposes, as well as meet the CGIAR's requirements. In order for this to be effective, clearly the CCERs need terms of reference to cover both sets of needs. Guidelines for composition, time invested, findings and recommendations, timeliness, and Centre/Board participation were provided by TAC. Where such criteria are met, the CCERs should be a principal source of information to the EPMRs on the second term of reference.

#### **3.1.2.2 CCERs conducted at IITA from 1996 to 2000**

IITA has initiated six CCERs since the 4<sup>th</sup> EPMR, including five on science components of the Centre. These are listed in Table 3.1 and the 5<sup>th</sup> EPMR has considered them thoroughly as a basis for responding to the second ToR on the relevance and quality of science over this period. As can be seen from the table, however, the Panel has found most of the CCERs to be of variable scope with respect to the amount of detail and degree with which they address any aspect of science quality.

The Panel has had difficulty in using the CCERs to assess science quality for the simple reason that they did not contain a specific ToR that addressed it. Later CCERs carried out between 1997 and 1999, on cereal-legumes, starchy staples, and the RCMD, did have sub-ToR on the quality of research output, among three other sub-ToRs within the general ToR on assessing the effectiveness of research and technology. Overall, the CCERs did not provide a rigorous review of science quality.

CCERs varied in length and thoroughness. Later CCERs were more detailed, and in one case (Starchy Staples, 1998), contained a wealth of valuable information on the relevance of the separate components of projects, a publication list that allows for analysis of this element, and sufficient detail on methods to allow for independent assessment. No other CCER provided this level of detail. The CCER on PHMD was not helpful, and recommendations were inconsistent. Nevertheless, some of the CCERs did have constructive recommendations on project management, structure and the Panel have found that on occasion, they provide a useful ‘stake in the sand’ as situation reports.

### **3.1.2.3 Ways to address limitations**

The 5<sup>th</sup> EPMR has thus had a significantly larger task than expected in evaluating the quality and productivity of science at IITA. Background information needed to make a realistic evaluation, included:

- Full publication lists for the period, by category (refereed journal, book, conference paper etc), identifying authors within the Centre.
- Science Citation Indices, values of the papers and journals.
- Documentation of other science outputs, such as new discoveries, models and other software, biological constructs (varieties, gene maps).

CCERs would have greater value and more constructive impact, if:

- there was a consistent set of focused ToRs, regarding depth of coverage, scope and quality of science;
- the Chair of the CCER team reported directly to the BOT, so that direct feedback to the BOT can take place;
- Adequate recommendations were required. The CCER on starchy staples only provided five recommendations, where many implicit recommendations hidden in the text would have been of value.

From the experience of the present EPMR, the Panel also considers that CCERs should be conducted within two years of the next five-year review, not immediately after the last EPMR. This allows time for the Centre to respond to the recommendations of the immediately past EPMR and for any CCER to be able to judge the effect of such responses.

## **3.2 Crop Improvement and Plant Genetics**

### **3.2.1 Programme Overview**

IITA's crop mandate is the widest in the CGIAR, covering six staple crops that feed the world's fastest growing population in the world's poorest continent. These crops are legumes, tubers and cereals as well as traditional crops (yam, plantain) and soybean, which is new to Africa and whose various potential uses are being discovered by local producers and consumers. The Panel commends the crop improvement team for doing an extraordinary job.

**Table 3.1 Panel's Evaluation of Centre-Commissioned External Reviews of IITA's Research Programmes 1996–1999**

Programme	Date	Duration	No. in Team	Field Visits	Value to EPMR	
					Scientific relevance	quality & Recommendations
Improving Post-Harvest Systems (project 9)	17 – 30 Nov. 1996	13 days	3	Kampala and vicinity (6 days) Ibadan (6 days) Moniya and Ojoo.	Nothing except some training materials and newsletter mentioned, but without reference to quality or number.	Despite lack of clear T recommendations on re for impact assessment, a strategic plan. Had th quality this would have
Plant Health Management Division (projects 3 to 6)	Nov.25 – 1 <sup>st</sup> Dec. 1996	7 days	3	Yes, around Cotonou	Not mentioned. No documents or lists of persons consulted.	One recommendation, quarantine facility was the expressed wishes o
Savannah Cereal-Legumes systems (Projects 8, 11, 12, 15 and 16)	21 Sept. – 1 <sup>st</sup> Oct. 1997	10 days	5	Yes, around Kano	Only a general reference to publications and in only two of the five projects reviewed. List of documents and persons consulted.	No direct recommenda Nearly all recommend: geared to the level of r
Management, administration and operations	26 April – 6 May 1998	11 days	3	Ibadan	Not considered here.	Used in the manageme
Starchy Staples Projects (Projects 7, 13, 14 and 16)	Sept. 21 and Oct.1, 1998	11 days	6	Not specifically mentioned but probably yes	Publication lists are provided with description of project outputs for each project. Documents or persons not listed.	Only 5 explicit recomn unfortunate because m: the text, which provide those given – including impact assessments.
Resource and Crop Management Division (Project 1, 2, and 10)	26 Sept. – 7 Oct. 1999	12 days	4	Yes, around Zaria	No publication list for output. List of documents and persons consulted.	Assessed publications recommendation. Seve recommendations on p adopted, others equally science, integration of for focus and clear hyp

\* Scale from 0 (not useful) to 5 (highly useful)

***Crop improvement in IITA's Project structure 2002-2004.*** IITA's breeding efforts are components of "cropping systems projects" focused on *Musa* (P2), yam (P5), cassava (P6) and cereal-legume associations in dry savannahs (P3) and more humid environments (P4). Some of the breeding for biotic constraints has been moved from the systems projects to projects focused on IPM. Project 1 (conservation and biodiversity) supports breeding by providing and characterizing germplasm, and by conducting genetic studies.

Crop improvement research has good linkages with pest/disease and natural resource management research, but its integration with AEZ research agendas could be improved. Socio-economics support and tools for extrapolation of results are sub-optimal. Links between breeding and the molecular crop improvement aspects of Project 1 (Conservation) are good. However there are no procedural or budgetary mechanisms to ensure that molecular tools are routinely used by the breeders.

The location of breeding activities is an important determinant of their effectiveness. In the future, much of IITA's breeding work will be concentrated in the benchmark areas (BA). Currently, five out of 13 breeders are located at Ibadan, three are at the mid-altitude BA in Uganda, one is at the future dry savannah BA (Kano), but none are located in the humid forest BA (Cameroon). The nine scientists working in biotechnology and the Genetic Resources Unit (GRU) are located in Ibadan. The Panel notes that decentralization of breeding research to benchmark areas is still ongoing.

***Place of IITA crop improvement research in the CGIAR and beyond.*** IITA has the global research mandate for cowpea, *Musa* and yam, and regional ones for cassava, soybean and maize. IITA takes a flexible approach to its commodity mandates. However, these mandates require in-house capacities for scientific leadership, technical proficiency and co-ordination of germplasm flow. This is currently the case for conventional breeding in IITA. The Panel commends IITA for having created a GRU that works closely with breeders at IITA, at NARS in the region and at other IARCs.

Complementary crop improvement programmes are at CIMMYT for maize, at INIBAP for *Musa* and at CIP and CIAT for tuber crops. Good links exist with these centres in the areas of germplasm and information exchange, but crop adaptation to acid soils in the humid tropics has been largely orphaned, despite strong complementarities among IITA, CIAT, CIMMYT and WARDA. Maize breeding for acid soils has been devolved to IRAD in the Cameroon, but this arrangement does not seem to work well. IITA should review the regional importance of maize and legume adaptation to acid soils and adjust priorities and partnerships accordingly.

***Place of IITA's crop improvement research in SSA.*** Germplasm improvement, transfer and conservation at IITA are firmly anchored in SSA through crop specific networks for germplasm exchange and testing. IITA's substantial investments in NARS (e.g., network-based subsidies for variety testing) serve not only to strengthen NARS, but are necessary to maintain a regional capacity for germplasm testing, which is crucial for IITA's breeding programmes. The Panel urges IITA to maintain and strengthen networks and to review them periodically.

The Panel recognizes that some of the previously strongest NAROs, Nigeria, Cameroon and Ivory Coast, have been affected by political and economic instability. NARO breeding capacity varies among crops. Maize breeding can build on comparatively strong regional capacities, and a gradual devolution of standard breeding components should be considered to Burkina Faso, Ghana and Cameroon, which have stable capacities and cover different AEZs. For cassava, 20 NARS in SSA maintain small research groups, typically one or two scientists that sometimes include a breeder. Three NAROs in East Africa, but none in West Africa, conduct cassava breeding. NAROs in West Africa essentially test and transfer cassava germplasm developed at IITA. By contrast, NARO capacities for cowpea breeding are relatively strong in four West African countries and collaboration with IITA is good. No linkages exist with CERAAS, a regional research centre in Senegal under CORAF, which specializes in crop drought resistance, and is a potential partner in cowpea physiology research. Modest breeding programmes for soybean exist in Ghana and Uganda, but none exist for *Musa* and yam in SSA.

Regional germplasm networks have been formalized to varying degrees. WECAMAN (maize) and EARRNET / SARRNET (cassava networks for East and Southern Africa) are stable and provide broad exchange and dissemination of germplasm. The Panel encourages IITA to extend networking for cassava to WCA. IITA has well-established networks for yam and cowpea agreed with CORAF, as well as informal but efficient networks for *Musa* and soybean germplasm testing and distribution. In general, more can be done to exploit the extraordinary amount of available information from multi-location trials for GxE analyses.

Regional networking in biotechnology is currently not possible for lack of potential partners. Marker Assisted Selection (MAS), not yet operational at IITA but soon to become important, will not be used by most NAROs in the near future. Transgenics is an option to introduce host resistance against pests and diseases for which no resistance is available within the species. This technology will soon be operational at IITA. In WCA, only Nigeria and Cameroon are currently developing biosafety policies but restrictive legislation, or the absence of biosafety regulations, may restrict the use of transgenics in many countries. This regulatory situation may evolve rapidly, however, and the Panel believes a biotechnological research capacity for African staple crops will be of increasing strategic importance for crop improvement. IITA is well placed to assume this function while ensuring maximal NARO co-ownership (refer to 3.7.6).

### **3.2.2 Accomplishments and Quality of Research**

Recent CCERs on starchy staples (*Musa*, cassava, yam) and cereal-legume systems (maize, cowpea, soybean) commend IITA for conducting efficient and relevant crop improvement. The Panel agrees with this general assessment. The number of improved varieties developed and distributed to NARS during the review period is impressive, as is the performance of these materials in multi-location trials. NARS estimates of mean on-farm yield gains with improved cassava and maize germplasm in 20 and 11 countries respectively are 49% and 45% (Manyong et al. 2000a; 2000b). These estimates are not quantitative and should not substitute for economic impact assessments, but they attest to a high appreciation of NARS for the quality of IITA's breeding products. Interestingly, estimates of yield gains in Cameroon are far below the regional average and may reflect specific soil constraints (soil acidity, Al toxicity, P fixation)

in the humid-forest AEZ that have not been adequately addressed by breeders. In terms of varieties, research output has clearly been greater in the savannah zones than for the humid forest zone, and reflects the allocation of scientist time.

The Panel wishes to highlight the following scientific accomplishments in crop improvement made, or consolidated, during the review period. These include the development of:

- maize genotypes with strong and durable resistance to streak virus
- maize and cowpea genotypes resistant to *Striga*, and identification of cowpea and soybean genotypes that may serve as trap crops for *Striga*
- maize genotypes with stemborer resistance
- cassava genotypes resistant to cassava mosaic virus (CMD)
- yam varieties producing acceptable yields without staking
- cassava and yam genotypes serving as donors for specific tuber quality traits
- development and integration into cropping systems of dual-purpose cowpea and soybean varieties
- development of elite soybean varieties adapted to African circumstances, enabling good nodulation (N fixation) under limited P availability
- RAPD markers to detect the presence of A or B genomes in *Musa*
- *Musa* genotypes with transgenic resistance to black sigatoka
- protocols for cryo-preservation of shoot tips (cassava, yam) and pollen (yam)
- establishment and electronic publication of a germplasm database.

With respect to publications, an average of 1.6-refereed articles were published by CID scientists per year between 1995 and 1999, for a total of 174. These publications include quality research on breeding methodology, genetics and trait analysis, as well as a number of crop physiological papers. Very few papers were published, however, on systematic G x E analyses and impact studies (including socio-economic factors relevant to variety adoption) and product quality (including nutritional value). The Panel suggests that technology development research needs greater economics input.

The published output on breeding methodology and genetics of *Musa*, about 12 articles per year, deserve particular mention. The output on cassava, cowpea and maize is respectable, and includes collaborative efforts involving IPM specialists, physiologists and agronomists. Most of the published papers on yams concern germplasm diversity and conservation. Strangely, no refereed journal articles were found on soybean improvement.

The journals used as outlets by CID scientists achieve relatively low impact scores, but are appropriate in terms of readership for information dissemination. In comparison with peers in academic institutions in developed countries, CID scientists are strong on germplasm development but fare less well on communicating the scientific basis of crop improvement in research journals.

### 3.2.3 Impact

### 3.2.3.1 Germplasm distributed and varieties released

During 1996-1999, the GRU dispatched 21,800 seed lots, 70,000 cassava plantlets and 60,000 yam mini-tubers to NARS and other collaborators. Large numbers of seed lots are sent out every year for regional trials (e.g., 443 sets of 150 cowpea lines in 30 countries during the review period).

The overall number of IITA bred varieties developed and released is also impressive: 206 releases for cassava in 20 SSA countries and 267 releases for maize varieties in 11 countries. The latter number includes 81 released by the private sector, including hybrids (Manyong et al. 2000a; 2000b). For all of IITA's mandate crops, the vast majority of varieties released in WCA originated from IITA. The available information is patchy, however, and the Panel believes that it would be in both NAROs' and IITA's interest to track regional varietal transfer and release more systematically.

It should be noted that mechanisms for release of varieties are not in place everywhere and are frequently inefficient, sometimes to the extent of seriously limiting dissemination. Many of the "releases" recorded for cassava and cowpea are informal, whereas maize releases are based on strict regulations. Nevertheless, if varietal release is a yardstick, IITA's record is outstanding.

### 3.2.3.2 Impact of improved varieties

The true impact of any crop improvement programme can only be judged over relatively long periods, covering varietal development, distribution and adoption. IITA claims in its MTP 2002-2004 that without its intervention, maize production in SSA today would be 25% less, and for cassava, even with biocontrol, would be 50% less. We consider these numbers only indicative, while the preferred measure of impact would be the sum of production increases (yield x area x cropping coefficient) resulting from substitution of existing technologies and from cultivation of new land. Such data are not available. As a further complication, some improvements are maintenance measures e.g. adaptation to evolving pest complexes, or aiming to offset decreasing soil quality. Last, any expansion of crops into more marginal environments will lead to a decrease in aggregate mean yields and therefore mask progress. These phenomena are prevalent in SSA and detract from apparent impact. Unfortunately, IITA has so far done little to document quantitative impact, and the new "Impact" Project (14) is still embryonic (refer to 3.4.4).

Available impact assessments of cassava varieties are based on estimates of national production and area cropped, fraction of area under improved varieties, and fraction increase of yield (improved Vs traditional varieties) provided by NARS scientists in 20 SSA countries (Manyong et al., 2000a). These results are weak because they are based on expert opinion. According to the analysis, production increase in SSA due to IITA bred cassava varieties was 10 million tonnes for 1998, covering the caloric needs of 14 million people. A comparable study on maize comes to similar conclusions (Manyong et al., 2000b). Available information on adoption of improved cowpea and soybean varieties is limited to specific study areas using household-

level studies (Sanginga et al., 1999; Inaizumi et al., 1999). The results demonstrate rapid adoption and positive effects on income, and in the case of soybean, improved human nutrition.

No specific studies on the impact of yam and *Musa* varieties were made available to the Panel. In general, there is no reason to believe that IITA varieties do not have a high level of adoption in their target regions, but quantitative information acquired with appropriate methodologies is needed to demonstrate the returns on investment.

### **3.2.4 Appropriateness of Objectives and Approaches**

#### **3.2.4.1 Breeding**

The objectives driving IITA's crop improvement research are comprehensive for each of the 6 mandate crops. They aim at developing crop varieties with greater yield and yield stability that are adapted to the relevant AEZs and cropping systems, resulting in "finished products" suited for adoption. There is excellent regional collaboration in the exchange of germplasm and testing in networks, with good geographic representation in WCA and with some IITA researchers hosted at NARS facilities. These exchanges and collaborations help build NARS capacity and provide feedback to IITA's breeding efforts.

**Cassava.** Cassava improvement research at IITA aims at improving yield stability, mainly through host resistance to pests and pathogens, while improving tuber quality in terms of low cyanide content and high protein,  $\beta$ -carotene and micro-nutrient content. Another objective is to develop short duration types for seasonally water-logged inland valleys.

Although impact has been substantial, acceptance of IITA materials has been limited by poor cooking quality in Cameroon. This has been corrected in the course of the past decade. In response to IITA's new emphasis on demand driven objectives, breeders are now selecting for a range of quality traits suited to specific uses. However, these objectives need to be refined with the help of socio-economists. A high level of yield potential has been achieved (e.g., > 100 t/ha tuber yield in Uganda) and the main issue now is yield stability. The impact of biological control achieved for mealybug and expected for green mite, enables cassava breeders to give greater attention to other traits, although new insect resistance issues will no doubt arise. Progress in developing resistance to cassava mosaic virus has been challenged by the appearance of a new strain, but this is being addressed. A fine example of breeders' appreciation of inter-disciplinary synergies is their commitment to breed for stay-green cassava varieties to sustain green mite predator populations.

The Panel commends IITA breeders for their close collaboration with IPM specialists, agronomists and economists, as well as their systematic use of multi-location networks for GxE analyses. In reviewing the cassava breeding activities, two opportunities were noted: (1) develop protocols to induce flowering in order to access a greater diversity of parental materials; and (2) develop acyanogenic varieties to reduce costs of processing, possibly using the gene elimination (knock-out) approach in collaboration with ARIs.

**Musa.** IITA's plantain and banana breeding programmes in Uganda and Nigeria have been very resourceful in creating a technical and scientific basis for systematic breeding, using polyploid progenies of crosses between AA and BB genomes. Given the newness of the techniques, the specificities of *Musa* genetics and limited genetic diversity available, a large proportion of the research is methodological and continues to be innovative (ex: RAPD markers for A and B genomes, flow cytometry for ploidy levels, AFLP band for parthenocarpy). Breeding objectives are related to quality and host resistances against Black Sigatoka fungus, root nematodes, *Fusarium* wilt, banana weevil and retroviruses. Agronomic objectives are earliness, short harvest-to-harvest intervals and short stature.

The specific technical difficulties associated with *Musa* breeding have motivated IITA breeders to seek innovative solutions to biotic stresses not only at the genetic level (MAS for Black Sigatoka and parthenocarpy) but also in collaboration with IPM specialists (endophytic *F. oxysporum* for nematode and parasitoids for weevil control). Another area of dynamic, inter-disciplinary collaboration is in propagation (tissue culture, sucker stimulation). The Panel commends IITA for its innovative and inter-disciplinary approach to *Musa* improvement, which should be sustained. Insufficient information is available on the economic losses caused by pests and diseases, particularly for plantain. The Panel was not able to visit the *Musa* breeding site at Onne, nor did it receive sufficient information to evaluate issues raised with regards to the appropriateness of the site.

**Cowpea.** Cowpea is a major source of protein and a fundamental component of the sustainability of cereal based cropping systems in the savannahs. The crop's main weakness is its susceptibility to insect pests. Doubts on future perspectives for cowpea breeding expressed in the 4<sup>th</sup> EPMP are not shared by this Panel because new perspectives are emerging for the control of insect pests, including transgenic resistance and biological control measures.

Breeding activities in the dry savannah AEZ seek to develop a range of ideotypes for different uses (grain, forage or dual purpose) and adaptations to cropping systems (based on sorghum, millet, and irrigated wheat or rice). Along with ideotype breeding, crop improvement also seeks to improve drought resistance (dehydration tolerance and deep rooting); resistance to biotic stresses (*Maruca*, aphids, thrips, *Striga*), enhanced BNF, grain cooking quality and forage nutritional quality. The Panel commends IITA for having geared cowpea improvement towards relevant agronomic objectives that take into account existing crop rotations and interactions with livestock, in collaboration with ILRI. The Kano site is a good choice with respect to local partnerships (cooperatives, NARS) and collaboration with ICRISAT. The economic importance of irrigation systems, such as those near Kano, should be reviewed, possibly in the context of a broad-based impact study for cowpea. The Panel also suggests that the Kano team carry its work more systematically to the moist savannahs where maize-cowpea systems are a promising option.

The Panel encourages IITA to put greater emphasis on insect pest resistance in cowpea, particularly the *Maruca* podborer, in collaboration with biotechnologists and IPM specialists. Proposals for the use of transgenic *Bt* cowpea must consider the social and political acceptance of GMOs in the region, as well as the probability of evolving pest resistance to *Bt*.

**Maize.** Among the AEZ, the moist savannahs have the greatest potential for maize production and hence have received the most emphasis in breeding. Some efforts are also directed towards the humid forest zone. The most important crosscutting constraint is the streak virus, to which a high level of host resistance has been achieved. Breeding materials are also systematically screened for dry milling quality, micronutrient content, and resistance to storage weevils and aflatoxin producing fungi. Recent progress has been achieved in stemborer resistance through conventional breeding but its stability in time and across environments needs to be demonstrated.

Specific breeding objectives for the moist savannah are resistance to *Striga*, efficient use of soil N, drought tolerance, and earliness. For the low- and mid-altitude forest zones, priority is given to resistance to stemborers, downy mildew, foliar diseases and ear rot. In the mid-altitudes, diseases such as highland blight, highland rust and *Diplodia* ear rot are important. The Panel endorses the high priority given to host resistance (including storage pests and *aspergillus* rot [aflatoxin]) and quality and processing aspects. The panel is worried, however, by the fact that separate breeding activities are being conducted for *Striga*, drought resistance and high N uptake/use efficiency. Since these constraints occur frequently together, a multiple resistance approach needs to be adopted to develop broadly adapted varieties.

According to IITA maize breeders, the development of new heterotic hybrids has been reduced to spill-overs from conventional breeding. This strategy may be reasonable given the high yield potential recently achieved with OP lines and the poorly developed seed sector in WCA. But the Panel sees no particular reasons for IITA to drop hybrid work if the impact justifies it and resources are available.

**Yam.** Compared to cassava, yam is restricted to more humid environments. Consumers have specific quality preferences. Although yam based systems account for 43% of agricultural production in the moist savannahs and forest zone (CCER Starchy Staples, 1998), the crop has been largely neglected by most research institutions other than IITA. High costs of production are due to vegetative planting materials (>60% of variable costs), mounding and staking. Similar to cassava, processed products are becoming an economic option. Major biophysical constraints to production are virus and anthracnose diseases and nematodes. Breeding for these has to cope with a narrow genetic basis and is at its early stage.

IITA's crop improvement objectives for yam are similar to those for cassava (high yield and yield stability at a good level of quality), with the additional objective to change the plant type such that staking is unnecessary. Breeders invest substantial resources in methodology and strategic research such as on grafting, dormancy management, multiple and early tuberisation, and stimulation of flowering. The Panel considers this strategy sound as it produces high yielding materials with the limited means currently available, while opening methodological prospects for more efficient and targeted breeding in the future.

It is likely, however, that if no breakthrough can be achieved in reducing costs of production, the economic importance of yam (and thus, the case for research) will decline in the long run. All options to reduce yam production costs should be evaluated, and plans for yam research adjusted accordingly. Future work might emphasize changes in plant type (tuber shape

and size to reduce mounding/tillage; crop architecture for improving radiation use efficiency in the absence of staking: sturdier stems, branching mode and angle). The Panel encourages IITA to consider a renewed research effort to overcome genetic barriers between *D. alata* x *D. rotundata*, potentially providing great opportunities for plant type improvement.

**The Panel recommends that IITA develop a concept and approach for yam ideotype breeding with the objective to render production less labour intensive in a systems approach.**

**Soybean.** Soybean improvement research objectives are similar to those for cowpea (early and full season types; high and stable yields for both grain and fodder; resistance to pests and diseases; promiscuous nodulation; grain cooking, nutritional and storage quality). Emphasis is on more humid environments where drought is of minor and low-P soils are of major priority. There is a geographic overlap with cowpea breeding (including the sudan savannah: soybean as a *Striga* trap crop). Crop associations are mainly with maize. Season-to-season seed storability is an important issue. Priority diseases are rust, *Cercospora* leaf spot, bacterial blight, bacterial pustule, soybean mosaic virus, and priority insect pests are defoliators and pod sucking bugs. Pressure is still low due to the newness and limited extent of the crop, but the expected spread of pests and diseases from Asia and elsewhere may require some pre-emptive breeding for resistance.

IITA's capacity for soybean improvement is limited (1 breeder), and it may not be realistic to pursue a similar scope of objectives as in cowpea. NARS' and producers' demand is high, however, and soybean is thought to be an upcoming major crop, particularly for market oriented systems. In this sense, soybean fits well into IITA's vision of a savannah grain belt, for which it seeks to develop diverse technology options. Soybean can be used for many purposes, including enrichment of starchy foods with protein, cheese and (infant-) milk substitutes, and flour. The Panel commends IITA for considering these specific end-uses in their breeding work on soybean.

### 3.2.4.2 Germplasm conservation

The CG centres have long been the curators of many of the world's major germplasm collections, and IITA, with mandated crops that are not grown in developed countries, plays a key role as the only repository of diversity of these species. The need for the Germplasm Resource Unit (GRU) as a source of breeding and research material continues to grow, as evidenced by the numbers of seed accessions, cassava plantlets and yam minitubers distributed to NARS.

Over the last few years the potential value of germplasm collections has been further enhanced by their 'genomics potential'. A key external development is that the genomes of one dicot (*Arabidopsis*) and one monocot (Rice) species have been sequenced. That means that most of the genes present in crop species are now known (although all functions are not). Germplasm collections such as found in GRU are the repositories of the available alleles of all the genes in key agricultural species. The potential for 'allele mining' represents a completely new role for the collections and an increased value of the associated genotypic and phenotypic databases.

The possible role of IITA in international genomics should be debated within IITA while the window of opportunity is wide.

Other external developments have affected the activities of GRU. In particular molecular marker technology has progressed from low-throughput hybridisation-based technology to high-throughput PCR-based methods, with even higher throughput ‘chip-based’ or ‘time-of-flight mass spectrometry-based’ under development. These advances have raised the possibility of whole genome scanning and launched the new (to plants) science of ‘association genetics’ not yet addressed by IITA.

Lastly we should note that implementation of the CBD protocols are beginning to have the effect of making much germplasm, including that from IITA’s client countries, less available. The implementation of TRIPS will further heighten awareness of the potential value of native germplasm and will likely restrict international transfer even further.

***Conservation, facilities, improvements in methods.*** GRU co-ordinates the collection, conservation, characterisation, evaluation, documentation and distribution of accessions of its major mandated crops and a range of other species of importance in the region - African maize, soybean, rice (for WARDA), sweet potato, Bambara groundnut, various other legumes and multipurpose trees. Although IITA has fewer seed accessions than some CG centres (at 35,000), the 6,500 field maintained and 3,900 *in vitro* maintained lines ensure that CGU remains a huge operation justifying the application of the present 14 staff. GRU also researches storage and conservation methods for its own crops. Notable advances in cryo-preservation of both pollen (yams) and shoot-tips (yams and cassava) have been made in the review period. The collections at IITA are housed variously in seed storage at  $-20^{\circ}$  C and  $-5^{\circ}$  C, tissue culture rooms and field plantations and arboreta. These facilities meet IPGRI standards and are adequate for near future projected activities. However, maintenance of the refrigeration plant, much of which is 20 years old, is likely to be factor in the near future.

***Databases.*** Available through the SINGER network for six of IITA’s crops, the databases are becoming increasingly valuable as they become more populated with agrobotanical and molecular characterization data. IITA should work with other centres in developing a policy in the use of crop databases in collaboration with ARIs and industry, particularly in relation to allele mining.

***Genotyping and association genetics.*** Over the review period, GRU has obtained considerable experience of molecular marker characterization of a range of species. This work is expected to accelerate breeding in the medium term. It has relied heavily on the use of RAPD but is now turning to SSR and AFLP as preferred marker systems, and the use of ‘diversity microarrays’ is being contemplated. This is a major opportunity for IITA and the time is right for a system-wide review of association genetics, which has considerable potential, taken with high-throughput genotyping, as an aid for breeding.

***Building NARS germplasm conservation capacity.*** IITA has carried out a great deal of training in germplasm conservation and related technology over the past five years. The Panel is pleased to note real progress in capacity in Ghana and Nigeria (particularly in Ibadan) and in the

growth of the Southern African Regional Gene Bank in Lusaka, all staffed by IITA alumni. GRU has acquitted itself well over the review period but will face the challenges of even greater change over the next. The Panel endorses IITA's range of conserved species, including indigenous crop species, and commends research into improved storage technology. The Panel notes that the conservation of the small African maize collection is no longer an issue. Duplication, particularly for yam, and the long-term security of the collections will be major issues. The approaches that IITA takes to the further characterization of the collections and the involvement of GRU in international genomics will be critical.

### 3.2.4.3 Biotechnology

The tissue culture and molecular science that constitute agricultural biotechnology are still quite new to IITA. A Biotechnology Research Unit was established in 1990, but was at first directed to defer activities in molecular biotechnology. The 1996 EPMP saw a small group that was just beginning to venture into molecular diagnostics and transformation of cowpea and banana. In 2000 'Biotechnology' was removed as a Project on its own and incorporated appropriately into the several breeding Projects. At the same time the old virology laboratories and the BRU are being converted into a temporary suite of Biotechnology Laboratories (BL). This would appear to be an ideal means to ensure that individual scientists continue to relate to the main mission of IITA while benefitting from day-to-day interaction with like minds and achieving economies of scale.

The Panel notes that, although not mentioned in the MTP, a new US\$ 1.5 million custom designed BL is in an early planning stage. Although BL staff span two divisions, the Laboratory aspires to develop its own identity with regular meetings and a seminar series. This is not yet the case and the breadth of work ongoing now is substantial, and gives the appearance of growing unchecked and uncoordinated. While the post of Senior Biotechnologist remains unfilled, the group remains without a leader.

Several biotechnology advances deserve note. A molecular map for Cassava has been developed with CIAT, and MAS, and transformation experiments are beginning to be carried out. For cowpea, a skeleton map has been produced and markers are being sought for key traits such as *Striga* resistance. In *Musa*, genome specific RAPDs are in use for ploidy analyses and molecular tagging of several key traits is underway. For yam, the first genetic map is being made and MAS is being contemplated.

***Transgenic crops.*** Some research into transgenesis and transgenic technology has been carried out on all of IITA's crops. However, as yet, in no case is the technology routine. Genotype specificity is often a problem and in few crops has the initial research genotype been chosen to be relevant to African agriculture. Nevertheless BL is well equipped with biolistics and tissue culture facilities. Moreover, for some applications, transgenesis could be the breeding method of choice, e.g., in cowpea breeding where resistance to podborer, *Maruca*, is not available in the primary gene pool, or for some entire crops, e.g., in *Musa* breeding where a conventional cross-breeding programme is fraught with difficulties because of ploidy. Nevertheless, even if more resources were applied to transformation, it is unrealistic to expect IITA to become a centre of excellence for genetic engineering in all its mandated crops. Almost

certainly IITA should rely on the experience of others and, for several of its crops, the first transformation experiments should be carried out elsewhere in collaboration with IITA. The Panel hopes that IITA will review its strategy and resources being deployed in this area. The aim of the review should be to ensure that IITA is making the best of present and potential partnerships and to prioritize its work within its mandated crops.

In some cases, the most appropriate links will be with other CG Centres. The existing, and already successful, link with CIAT should be strengthened for cassava biotechnology. The recent successes in overcoming difficulties previously associated with importing live cassava material should be a boost to the transformation research. Similarly, IITA should work more with CIMMYT in its maize transgenic breeding. Although transgenic approaches are likely to be a priority in *Musa* breeding, the development of existing linkages, e.g., with the Catholic University of Leuven, Belgium, is likely to be more profitable in the short term than developing the technology at IITA. It is unlikely however that other centres, particularly in developed countries, will concentrate on transformation of African tropical crop species. The Panel suggests that IITA concentrate transformation efforts on cowpea resistance to *Maruca* podborer as the key target and maintain a watching brief on yam, while other biotechnology aspects, such as the genetic map, are under development.

Experience elsewhere has shown that the transition from initial transformation success with a single tractable genotype to the development of facile, general technology appropriate for day-to-day breeding applications can take years rather than months. It is clear then that IITA's ideal collaboration with other Centres and ARIs should be medium to long term. Short, linkages of less than two years will produce little.

The development of improved new varieties is, of course, rather more than just acquiring transgenic technology. IITA Management will note that introducing insect resistance into cowpea is not a trivial project and will involve input beyond just BL, even if *Bt*, rather than a new resistance gene isolated from African wild *Vignas*, is the route chosen. Simply developing a 'clean' transgenic line that can be field-tested in the region will require technology development and collaboration, interaction with companies, negotiations on IP matters and the implementation of a regulatory framework that will allow the trials to take place. Even with the unknowns surrounding durability of resistance, a focus on the project could provide a worthwhile 'flagship' vehicle for IITA to address most of the issues that are already prominent in developed agricultures. A trait that directly benefits the consumer might have been better but in Africa, the farmer and consumer are more closely associated than in Europe or the US.

Although it looks unlikely that transgenic field testing guidelines will be implemented in the near future in Nigeria, IITA should continue to develop working relationships with countries in the region, e.g., Uganda, Kenya and South Africa, which have already taken that step. The transgenic black Sigatoka resistant bananas already developed would make a good test case.

**The Panel recommends that IITA initiate in the framework of CORAF/WECARD, a regional scientists' forum on the development and use of genetically modified crops, which gives NARS Scientists a sense of co-ownership in transgenics research and might serve as the nucleus for a future network.**

**Links with ARIs.** Several projects are carried out in collaboration with ARIs. On the whole, these interactions are beneficial, in that the project gets carried forward rapidly and the individual IITA scientists enjoy first-class interactions (see Section 4.4). However, in order for the Centre to derive corporate benefits from these experiences, a strong and credible leadership on the ground is needed that will ensure new technologies are assimilated into a co-ordinated and focused programme.

**Overall.** The Panel is convinced that approaches using molecular diagnostics for pathogens, molecular markers for diversity studies and marker-aided selection in plant breeding programmes, and the use of transgenesis in those programmes are all as legitimate in Africa as they are elsewhere (see Section 3.3.4 for cautions). The emphasis by which most gains can be made, with which technology, and for which crops will however be very specific to WCA's needs and the comparative advantage developed in BL. With the withdrawal of CAMBIA from the leadership role in biotechnology at IITA, this would be a very good time to step back and look closely at the programme.

### 3.2.5 Future Directions

In the medium to long term, IITA intends to undertake “crop improvement activities for all crops as required to fulfil the ecoregional mandate”, with emphasis on its current mandate crops at the present geographic scope (Strategic Plan 2001-2010). This outlook, however, will evolve with the forthcoming restructuring of CGIAR activities in Africa (MTP 2002-2004).

IITA intends to consolidate its current shift in emphasis towards market-oriented production systems that use more external inputs, while implementing the benchmark area approach. This results in an increasing emphasis on product quality, processing and nutritional value, and is presenting plant breeding with new challenges. The newly initiated project 14 (Impact, policy and systems analysis) will play an important role in providing a quantitative basis for this vision, and in guiding priority setting for breeding.

The MTP 2002-2004 presents, without commentary, a very large number of outputs (84), priority activities (134) and milestones (449). There is a list of 113 research results for 2000 by project, but linkages to the research plans are not apparent. It is impossible to judge from this presentation how the choices in crop improvement research (or any other area, for that matter) are related to the agreed goals and objectives, how they are evolving, and how important they are.

**The Panel recommends that IITA develop and present clear priorities for crop improvement research, structured and justified on the basis of relevance to the target environments and users, the Institute's comparative advantage, and the prospects for achieving impact.**

The Panel will therefore comment only on selected research plans described in the MTP:

- *Technology transfer.* Transfer not only of genetic materials, but also of sets of breeding technologies to selected NAROs (ex: *Musa*; Ghana, Ivory Coast and Uganda). The Panel commends IITA for this initiative and suggests to actively seek more such opportunities wherever NARS are ready
- *Participatory varietal selection.* Broader implementation for yam and other crops. The Panel commends IITA for seeking producer and consumer feedback to its improved varieties, but warns against investing a disproportionate amount of scientist time in the extension component of that work. It should also be kept in mind, given the time it takes to develop a variety, that breeding objectives should anticipate future demand, and not necessarily today's.
- *New breeding objectives.* High-protein for cowpea, systematic selection for improved nutritional value and quality in yam and cassava. The Panel commends IITA for making this a priority.
- *MAS.* 250 markers available for cowpea, MAS for virus resistance in cassava operational. The Panel firmly believes that this is the correct direction.
- *Transgenics.* Banana genotypes with antifungal transgenes field-tested in Kenya; transgenic resistance to viruses and insects available for cowpea (*Bt*) and *Musa* breeding; transformation and regeneration system operational for yam. These objectives are scientifically appropriate but technically ambitious, requiring substantial strengthening of Biotechnology. Before investing, the future acceptance of GMOs in the region needs to be evaluated.
- *Conservation.* Storage of shoot tips and pollen in liquid nitrogen fully operational for yam and cassava; molecular characterisation of yam collection. The Panel strongly supports this objective for its strategic nature, and urges IITA to implement this approach for all vegetatively propagated species of interest.

An issue not addressed in the MTP, but extremely relevant to breeding, is how far the comparative advantage of a specific crop extends into marginal environments. There is a general trend in WCA for improved crops to move into more marginal ecologies: maize, cassava and soybean moving north into drought prone areas; cowpea and soybean moving south into wetter areas. Breeding for short duration and drought resistant materials has certainly enhanced this trend and likely reduced regional mean yields. Crops cultivated in marginal situations (e.g., drought risks) are not likely to receive external inputs, thus raising sustainability issues. What economic and environmental impact can be expected from crop improvement addressing more marginal or favourable environments, and how much does the research cost? What is the current and future balance of IITA's efforts in this respect? As resources become scarcer, IITA may wish to consider a further concentration of crop improvement efforts on the anticipated core areas of crop production. This requires co-ordination with ICRISAT and ILRI along the N-S climatic sequence of WCA.

Two strategic issues regarding the place of molecular research and germplasm conservation require a broader discussion at different scales (region, CGIAR, N-S dialogue). The

first is functional genomics and transgenics, expected to overcome barriers to allele transfer among species and to achieve targeted gene expression. IITA can theoretically make great contributions to this with its germplasm collection and general expertise on its mandate crops, but progress would depend on strong and durable partnerships with ARIs while ensuring that its core resources continue to be used for its mandated mission. This is a global issue requiring concerted discussion and action, as appropriate. The second issue is increasing value to the region and to the global community, and the increasing maintenance costs of IITA's germplasm collections. How secure are they, how will costs evolve, who will pay for them? The Panel feels that competition for funding between IITA's core research and routine maintenance of the germplasm bank is inappropriate and suggests that independent funding be actively sought.

### 3.2.6 Overall Assessment

The Panel commends IITA for the good links of crop improvement research with agronomy and IPM, and excellent breeding support from the virology unit. However it notes that improved backup from socio-economics and physiology / modelling / GIS is necessary to allow ex-ante and ex-post impact assessments essential for a more quantitative basis for setting priorities. These analyses should also examine the balance between breeding efforts for more marginal environments versus favourable ones. For the drier areas, this should include meteorology based risk analyses. The Panel commends IITA for recognising the importance of quality traits and encourages the centre to strengthen the processing and marketing aspects of this work.

IITA's crop improvement work is 30% of its research effort and covers six staple crops. Because of relatively limited NARS capacity for breeding, IITA is forced to run a "complete" breeding strategy aimed at developing finished products. The Panel recognizes the rationale, but urges IITA to more actively explore: (1) gradually devolving maize work to NARS; (2) strengthening collaboration with CIMMYT, CIAT and IRAD (Cameroon) to ensure adequate crop improvement for the humid forest zone; and (3) achieving better integration of crop improvement within and across projects by integrating breeders in the emerging AEZ benchmark teams.

The Panel commends IITA for its expansion of breeding methods. For example, the Panel was impressed with the use of efficient and low-cost screening methodologies for drought resistance and tolerance, *Striga* resistance and cowpea grain quality at Kano. The "conventional" repertoire is being progressively complemented with innovative cytological and molecular technologies and novel approaches to vegetative propagation, floral induction and seed dormancy, all aimed at accelerating the breeding process. MAS is not yet operational, and IITA may wish to concentrate efforts on the most promising and relevant traits while developing a centralized automated MAS facility. This should be one aspect of a review of priorities for the integration of biotechnology in the IITA's breeding programmes. Part of this capacity could be out-sourced, particularly in the transgenic area. The Panel also notes that scientific leadership in biotechnology is needed within IITA on a permanent basis.

While the technical feasibility and possible deployment of transgenics produced by IITA remain shrouded in uncertainty, the Panel suggests that IITA concentrate in-house on those few

targets where genetic transformation represents the most promising approach. Efforts should also be made to open access to trials in those counties with the existing legislation.

### 3.3 Plant Health Management

#### 3.3.1 Programme Overview

IITA's PHMD has the largest research group devoted to biological control - integrated pest management (IPM) in the CGIAR, with 17 of its 31 IRS stationed in Cotonou, Benin. PHMD has a diverse staff and research portfolio that includes biological control, IPM, biopesticides, host plant resistance, germplasm health, and biodiversity. Among the major goals of PHMD is the development of sustainable ecologically based biological control / IPM solutions to important pest<sup>3</sup> problems in SSA. Chemical inputs in SSA agriculture are minimal in most crops and hence have had a marginal impact on IPM practices in the area, but this may increase with intensification of land use.

The CGIAR Guiding Principles on IPM assert it should be interdisciplinary, holistic, maintain and utilize biodiversity as the foundation of pest management, and integrate farmers in the research from the problem diagnosis phase through to on farm implementation. Furthermore, IPM adoption by farmers should be based on their understanding of ecological and economic principles that underlie IPM<sup>4</sup>. Much of the PHMD research has been holistic and meets the spirit of the CGIAR's guiding principles. The research has been agroecosystem in scope and tritrophic in perspective including the dynamics of the plant, pest(s), and natural enemy interactions as affected by soil factors and weather. The research has often been process oriented using elements of dynamic systems modelling to link component processes and species interactions. Within the CGIAR, PHMD has had comparative advantages in the area of biological control, IPM, and agroecosystems analysis that are important components of AEZ level research.

PHMD has established excellent relationships with NARS during the biological control of cassava mealybug campaign that continue as research and implementation activities are extended to other biological control and IPM projects. The Panel commends PHMD for this networking-outreach effort.

#### 3.3.2 Accomplishments and Quality of Research

The Panel has measured accomplishments and quality of PHMD research by its relevance to the mission of the CGIAR, international public good, and the impact in solving food security

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<sup>3</sup> Pest may be of any taxa.

<sup>4</sup> Definition of *Integrated Pest Management (IPM)*:

IPM is defined as ecologically-based pest management that promotes the health of crops and animals, and makes full use of natural and cultural control processes and methods, including host resistance and biological control (introduced natural enemies). Chemical pesticides are used only where and when the above measures fail to keep pests below damaging levels. All interventions are need-based and are applied in ways that minimise undesirable side effects. Pests are defined broadly to include all organisms adversely affecting the health of crop plants and domestic animals. (SP-IPM Annual report 1997-98).

problems and alleviating poverty in Africa. Also used are international measures of scientific excellence. Only some of the many research accomplishments are reviewed below by crop or identifiable research areas.

*Banana and Plantain:*<sup>5</sup> Banana and plantain are important food crops in many areas of Africa, the Americas, and Asia, and important multi-cellular pests in Africa are the exotic banana weevil and nematodes. Much of the PHMD research focused on developing base information and methodologies for banana/plantain production and IPM. Specifically, considerable progress has been made in pest and disease resistance breeding and in developing IPM practices. A monograph summarizes progress in screening *Musa* germplasm. The identification of biological control agents for banana weevil is a promising development.

*Cassava:* PHMD has had spectacular successes in the biological control of cassava pests, but research productivity during review period was comparatively lower reflecting shifts in emphasis to other crops. Especially noteworthy was the solution of the Whitefly vectored cassava mosaic disease in Uganda, Kenya and Tanzania using IITA virus resistant varieties (see 4.1.2). The ongoing biological control of the cassava greenmite using the introduced predatory mite *Typlodromalus aripo* and fungal pathogen *Neozygites floridana* is highly significant. Other achievements include modelling the cassava tritrophic system (see below), evaluating the role of pathogen for control of greenmite (see biopesticide section), studies on the biology of two predatory coccinellids of the cassava mealybug, and the impact of two *Encarcia spp.* parasitoids on the control of spiralling whitefly. PHMD review articles stress the need for economic analyses, outline protocols for biological control introductions to Africa, and stress the dangers of establishing quarantine facilities in Africa (see sections 3.7.3 and 3.7.6).<sup>6</sup>

*Cowpea:* Species of cowpea are native to Africa, and although there are several potential pests, only the native podborer (*Maruca vitrata*) and the flower thrips (*Megalurothrips sjostedti*) are serious and received most of the attention. With the goal of developing IPM strategies, research has examined their phenology and migratory habits, rates of parasitism on cowpea and wild hosts, the effects of host plant resistance on both, and pheromone trapping of *Maruca*. The use of intercropping of cowpea with maize for the suppression of the parasitic plant *Striga* in the dry Northern Guinea Savannah (NGS) is noteworthy. The Panel notes with concern that IITA has four groups doing extension/IPM work on cowpea in the NGS of Nigeria: IITA/ILRI livestock interaction studies, PRONAF's cowpea IPM studies, SP-IPM *Striga* inter-cropping pilot site, IITA's breeding effort, and IITA's RCMD has bench mark area characterisation studies. These groups do not appear to collaborate among themselves nor with IITA's PHMD which has the mandate, experience and technical know how in IPM. The Panel suggests that measures be taken to minimize this costly duplication of cowpea IPM extension.

*Maize:* The maize project has many important research components, among which are research on aflatoxins and related problems, downy mildew, stored product pests, maize stem and cob borers, pathogen diagnostics and control of parasitic plants.

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<sup>5</sup> This research group suffered the tragic loss of three scientists during January 30, 2000.

<sup>6</sup> The last review team of PHMD recommended the establishment of quarantine facilities in Africa against the expressed wishes of PHMD's management.

*Aflatoxin* produced by the fungus *Aspergillus flavus* in stored products is an increasing health concern in SSA. Amongst the diverse topics researched were the ubiquity of aflatoxins in nature, basic biological studies on various fungi, sampling protocol for fungal presence, fungal seed transmission mechanisms, biometrics studies of fungal incidence in the field, marginal analyses of multivariate models to determine the effects of various factors that increase aflatoxin levels, analyses of farmer interviews to evaluate the efficacy storage methods on grain beetles infestations, and the effects of maize varieties on aflatoxin levels. The research broke new ground in assessing aflatoxin problems in Africa and in devising methods to minimize loss of yield and quality in stored maize.

*Downy mildew* is a localized problem in maize in SSA, and research has emphasized screening germplasm for resistance, seed transmission of the pathogen, field biology of conidia production, the effects of disease incidence in sequential plantings of maize, and the development of the disease in crop and native grasses.

*Exotic grainborers* are important pests in stored maize causing direct yield loss and increasing conditions favourable for aflatoxin producing organisms. Research has focused on biological control and developing IPM tactics to reduce losses in grain stores. Notable research highlights were to determine under which conditions biological control by the exotic predator *Teretrius nigrescens* was effective and the development of population dynamics models of the pests in grain stores, models for damage assessment, and sampling decision rules for estimating grainborer densities and damage. The models developed were imbedded in a simple GIS that could be used in region-wide ecological and economic analyses (see 3.6.1). This research will aid the development of IPM strategies for stored grain pests in Africa and elsewhere. The work benefited from collaboration with a Danish collaborator.

Several native species of *stemborers* have become important pests of maize. In addition, an exotic species (*Chilo partellus*) accidentally introduced into East Africa from Asia is spreading and in some areas appears to be displacing native species. Work is in progress on all of these pests. Research to develop and implement IPM strategies for control of stemborers by exploiting their strong preference for native grasses relative to maize is well advanced. Other IPM research included the developing sampling plans for stemborers, determining the species complex and their phenology in maize and wild hosts, and yield loss assessments using field surveys. Biological control of native species is more difficult than biological control of exotic species, and to meet this challenge the PHMD group evaluated native parasitoids for redistribution within Africa where they occur naturally. A 1998 review article provides a good overview of all IPM options on stemborer with appropriate cautions. The innovative work on the role of soil microbes and soil fertility in *Striga* dynamics is promising.

The Panel commends the maize group for its quality research, but notes with concern that many of the scientists in this project have left IITA.

***Germplasm health.*** The research conducted by PHMD's Virology Unit reflects its mission within IITA's mission as outlined in the 2001-2010 Strategic Plan. The unit characterized the effects of temperature on field isolates of banana streak badna virus (BSV), compared the incidence of BSV in plantain hybrids and land races, estimated the natural

incidence of BSV in field genotypes in Nigeria and Cameroon, examined the interplant variation and isolation of BSV, and characterized potyvirus in yams. Molecular characterization of insect pathogens and other diseases are routinely performed for colleagues as part of co-operative efforts: this is a selfless task.

***Biopesticides.*** Many fungal pathogens are ubiquitous in nature but require specific environmental conditions to infect target organisms. To develop useful biopesticides, difficult biological and technical obstacles must be resolved. The LUBILOSA project was responsible for the development of the *Metarhizium* based biopesticide GreenMuscle® for control of grasshoppers and locusts. To facilitate further developments on biopesticides, IITA has formed a partnership (International Biopesticide Consortium (IBCD) with CABI, NRI, and others). The development of IPM strategies based on biopesticides requires considerable backstopping biological and ecological research. Among the laboratory studies were pathogens effects on feeding rates, non-target effects, locust behaviour after infection, and the effects of grasshopper temperature regulation on pathogen activity and efficacy. Field studies on the pathogen include analyses of pathogen dispersal after field applications, between season survival, effects of sunlight and temperature on pathogen germination and persistence, molecular characterisation and dendrogram analyses of field isolates, and effects of rehydration on pathogen viability. Much of this data would be used for the development of population dynamics models for evaluating and evolving biopesticide based IPM strategies. PHMD publications reviewed the future prospects for microbial control of pests in West Africa, the development of technology for production and aerial application of *Metarhizium* conidia, and the development of strategies for the use of bio-pesticides in locust/grasshopper IPM.

The Panel commends the biopesticide group for its innovative and goal-oriented research successes.

***Modelling and systems analysis.*** PHMD scientists and collaborators in ARIs have developed and field validated physiologically-based models for cassava, cowpea and maize growth and development as modified by soil fertility and weather. A meta-population simulation model and a multivariate regression model of the cassava system were used to assess plant-pest-natural enemy interactions. Models were also developed for grain beetle dynamics and damage that may be combined with the work on aflatoxins provide a basis for evaluating post harvest losses and quality in maize. These field dynamics models are very sophisticated and are in many respects unique within the CG system. While modelling expertise has existed within PHMD for some years, relevant GIS expertise within IITA to implement these models regionally has been lacking hampering biological and regional evaluations.

The Panel commends PHMD for its forward-looking efforts in modelling and the use of econometric methods in impact assessment.

***Quality of science/publications.*** The majority of the papers published by PHMD scientists were published in appropriate journals and the science reported was highly relevant to PHMD's mission within IITA. PHMD scientists published more than 250 papers, book chapters and abstracts during the period under review. This is the highest rate of productivity per scientist among the divisions. African scientists were lead and co-authors on 57% of refereed

publications and 58% of all proceedings and book chapters. Many of these scientists were IITA Graduate Research Fellows in PHMD indicating significant contributions to capacity building of and networking with NARS. Co-operative research efforts also occurred with many leading ARIs resulting in co-authorship of 40% of the refereed publications and 27% of all proceedings and book chapters.

However, the Panel noted unevenness in research outputs among and within PHMD research groups. To assess the trend in scientific productivity, PHMD's list of publications for the period reviewed was used to compare the output of the current IRS with IRS who have left or are due to leave PHMD. No correction was made for the time since the termination or hire. On average, current IRS had 7.5 publications in refereed journals and those that left had 16.6.

The Panel is concerned that productivity in PHMD appears to be declining.

**The Panel recommends that IITA assess the research output of all IRS and NRS to help maintain PHMD's world-wide reputation in biological control and IPM.**

### 3.3.3 Impact

The spectacular control of the cassava mealybug by an introduced parasitoid was the first of many successes and yielded economic returns of 200:1 (Zeddies *et al.* 2001). One could easily surmise that without biological control, mealybug would have destroyed most of the cassava crop across Africa. This project was unique in its geographic scale, organization and level of documentation, and has become a classic text book example.

Ongoing biological control of cassava greenmite, mango mealybug, and spiralling whitefly were briefly covered in the 4<sup>th</sup> EPMR, and during the intervening period each project has made significant positive impact. The estimated 100% internal rate of return of control of greenmite is an indication of the importance of this work. Unfortunately, the full success of the greenmite research remains largely undocumented. Documenting the benefits to resource poor farmers of the biological control of mango mealybug, spiralling whitefly, native stemborers, cowpea thrips, larger grainborer, water hyacinth, and fungal pathogens to control grasshoppers, is ongoing but difficult (see Waibel, 1999). A study of the biological control of three exotic homopteran pests in Africa was done *ex post* by biologists and is an important document assessing the impact of PHMD efforts in this area. Water hyacinth made many lakes and waterways in SSA impassable and adversely affects the local economy and biodiversity. Control of this weed was first achieved in Northern Australia, and IITA scientists introduced natural enemies to SSA where good control is apparent in locations as far afield as Benin and East Africa. The latter was a co-operative effort with the National Biological Control Unit of Uganda. Partial success has been achieved in the biological control of larger grainborer in maize stores and cowpea thrips. Biological control of native stemborers of maize and other cereals and podbores in cowpea is generally more difficult and IPM strategies are being developed to minimize their impact as well as that of grain borers and cowpea thrips (see above).

IPM research has been increasing in PHMD as suggested by the 4<sup>th</sup> EPMR, but the impact is as yet largely unquantified. The maize-legume intercropping programme for *Striga*

suppression and improving soil nutrients has made significant gains and farmer acceptance is promising (see section 4.1.2). The location of the SP-IPM Secretariat in IITA is an indication of IITA's comparative advantage in IPM. The addition of an economist to PHMD should help resolve past problems in impact assessment (Section 3.5).

Substantial innovative progress on biological control of grasshoppers, locusts, termites, and greenmite using fungal pathogens has been achieved and is an important milestone in PHMD's portfolio of research success. The links to the private sector commercialising biopesticides is noteworthy.

PHMD has had a good record of training African scientists (88 during the period 1996-2000). The impact of this capacity building is reflected in the number of co-authored publications with African scientists (3.4.2) and their numbers in NARS throughout SSA.

The Panel commends PHMD for its stellar efforts in this area of capacity building.

### **3.3.4 Future Directions and Perspectives**

**Biological control.** Beginning in the mid 1980's, IITA began developing a strong reputation in biological control and to a lesser extent in IPM. The incorporation of IPM in 1991 into the newly formed PHMD marked an important disciplinary transition to a broader focus and was re-enforced by the 4<sup>th</sup> EPMR. The 5<sup>th</sup> EPMR Panel wonders whether these shifts have eroded the capacity of PHMD to respond to new crises requiring biological control expertise. Cassava tuber scale requires PHMD attention, as do other pests now and in the foreseeable future.

With a caveat, the Panel encourages greater efforts in biological control of exotic weeds. The Panel recognizes that such efforts require that rigorous testing of weed natural control agents must be done outside of Africa likely limiting effort to special cases such as water hyacinth where the natural enemies are well known.

**IPM activities.** The development of IPM strategies requires considerable specialized skills and the extension of IPM likely requires a different set. The Panel suggests that the offices of SP-IPM and NARS be used where possible to extend IPM finding efficiently, releasing PHMD scientists to solve other biological control and IPM problems.

**Linkages to NARS.** PHMD has had a remarkable impact on the scientific infrastructure of West African NARS, and the Panel encourages maintenance and possibly expansion of these infrastructure-building efforts.

**Systems analysis.** The ongoing push at IITA to organize according to AEZ and projects makes PHMD's progress in developing physiologically-based systems models even more important.

**Transgenic pest control.** The uncritical use of biotechnology to solve agricultural problems in developing countries was questioned by PHMD's Neuenschwander and Markham

(1999), who assert that the social and economic perceptions of the recipients should be considered, that greater emphasis should be placed on the sustainability of cropping systems, and that its productivity should be examined from a systems perspective (see also Zadoks and Waibel 2000). A similar caution has been expressed by various NARS in SSA, likely because of the ongoing debate in developed countries. The issue is raised here as part of food security issues in SSA using the interaction of predatory mite *T. aripo* and cassava greenmite as a cautionary example. This predator feeds predominantly on maize pollen when greenmite numbers are low (S.J. Yaninek, Personal communication); thus, if *Bt* maize were to be introduced to SSA, even sub-lethal effects of *Bt* pollen on the predator's vital rates might disrupt biological control of greenmite and negatively impact cassava production. This cautionary note flags a known interaction that must be investigated in an interdisciplinary way before *Bt* maize is introduced to SSA.

### 3.3.5 Overall Assessment

PHMD is at a crossroad where many of the scientists that built its reputation have left: therefore, the leadership needs to assure that a strong research culture is maintained. Biological control continues to be one of strong but appears to be losing some of its identity. This will be further compromised by the shift to the AEZ and project mode.

An area where PHMD has a comparative advantage is the use of modelling as a unifying framework for field ecological studies. Models and the systems they describe may be used as part of a GIS for evaluating regional problems in cropping systems from biological and/or economic perspectives (see 3.5.1). With IITA moving towards an AEZ and projects mode, dynamic systems modelling becomes an important methodology for integrating research findings across disciplines and AEZ. The key to the success of such an approach is the selection of project leaders with a system dynamics perspective and good science management skills (see 4.1.2).

## 3.4 Resource and Crop Management Research

### 3.4.1 Programme Overview

One of IITA's two overarching objectives is to develop and improve systems for the effective management and conservation of natural resources for sustaining agriculture. In simple terms, the EPMR must therefore ask whether the RCM research programme is achieving this goal.

Traditionally, RCMD's objective has been to improve productivity of smallholder farmers in humid and subhumid tropical Africa, while conserving the natural resource base. This work focussed on the declining soil fertility and overall natural resource deterioration that occurs with increasing population pressure, and reduction in fallow phases of traditional slash and burn agriculture. A substantial body of knowledge now exists, to which IITA has been a major contributor, on the relationship between resource condition, farming systems and land use patterns for the humid and subhumid forest and moist savannahs of western and eastern Africa.

In summary, the change from long to short fallows is invariably associated with reduction in soil fertility, physical condition and microbial biomass unless productivity is maintained by appropriate soil management. There is an increase in intractable weeds and the permanent loss of forest canopy tree species. Leguminous cover crops and mosaics of perennial and annual food and cash crops can provide more secure food and cash returns, but acidification, depletion of potassium, phosphorus and minor nutrients are not halted except through artificial inputs as well as organic residues. Intensification towards continuous cropping is frequently associated with increased susceptibility of staple food crops to pest and disease attack.

At the time of the 4<sup>th</sup> EPMP the resource and crop management research programme had just been through a significant period of revision. The expectation was this would involve more work with CID and PHMD. RCMD was identified as the division to lead the ecoregional approach and the development of benchmark areas.

In the past five years IITA's agronomic research has become predominantly located on-farm, in a participatory approach with collaborating farmers and NARS partners in line with the CGIAR's recommendation. (CGIAR 1997). Work has moved to integrating improved varieties of soybean, plantain, cowpea, maize (and to a lesser extent cassava and yam) with farming systems that will be more sustainable under the conditions of short fallow or continuous cropping that now prevail in most of the moist savannah and previously forested coastal zone. In the humid forest AEZ, emphasis is being placed on how to retain the environmental and socio-economic benefits of forest canopy in multi-tiered perennial and annual crop systems that provide village income.

### **3.4.2 Accomplishments and Quality of Research**

**Resource management.** In the past five years, IITA has consolidated research findings on cover crops, fallowing and weed management and their individual effects on soil fertility under different climatic and edaphic conditions. In the humid forest zone, much of this work has been co-ordinated under the system-wide programme Alternatives to Slash and Burn (ASB). This has provided a substantial body of knowledge on the quantification of nutrient cycling under different fallowing periods and changes to land use in this AEZ, that has been summarized by Kotto-Same et al. (2000). This work forms the basis for modelling estimates on carbon balances. Further work has confirmed the value of cover plants on weed suppression in short forest fallows.

The relationships between soil biological components, including macrofaunal constituents, such as earthworms and termites, functional groups such as rhizobia, and overall biomass activity have been further elaborated, in relation to residue decomposition, nutrient cycling and management practices in the moist savannahs, and degraded forest systems. These findings predominate in publications for the period 1995-2000.

Much of the work on characterization and process-level understanding of soil chemical and biological behaviour under different plant assemblages is now at a mature stage and the number of publications on these topics in the past five years attests to this. The Panel commends

the efforts to come to completion on soil process-level work, to form a sound basis for future moves to a systems-based approach.

***Crop management practices.*** In crop management, research efforts have concentrated on integrating dual cereal-grain legume systems using improved germplasm releases in maize (and sorghum) with cowpea or soybean for the dry and moist savannahs, and in cassava, banana/plantain, yam systems in the humid forest and mid altitude zones. The CGIAR award for Promising Young Scientist in 2000 went to an IITA scientist working on nutrient management in these systems.

Good progress has been made in the development of agronomic practices that allow phenotypic expression of the genetic potential of new varieties, particularly in the cereal-legume systems. These systems are attractive to farmers and have had a rapid uptake rate in northern Nigeria. Visiting Kano State, the Panel was told of 10 000 farmers in three villages in Kano State adopting new dual-purpose cowpea within two years of release. Expansion of food and dual-purpose cowpea has extended the range of this crop into more humid environments. In some areas, such as Benue State, soybean has moved from its traditional role as a male-controlled minor export crop to being adopted by 75 and 62% respectively of male and female farmers (Sanginga et al., 1999).

Cassava is the most rapidly expanding crop in SSA, and is projected to double production in the next 20 years, according to IFPRI. Progress in plant breeding for yield, disease resistance, improved quality, and plant protection successes in controlling the catastrophic effects of cassava mosaic virus and green mite, has been extremely impressive. However, longer-term soil fertility implications of rapidly increased expansion and yield in cassava also need to be kept in mind. The 4<sup>th</sup> EPMP raised concerns over the excessive depletion of soil nutrients that might imperil the sustainability of cassava. Today, sustainability of cassava crop systems still appears to be an issue, as is also the case for yam, a preferred traditional crop but one with very high production costs. 'Best bet' options for different ecoregions that take account of pest and disease management, soil fertility and labour are yet to be fully developed, although inter-cropping of short-season legumes with the early stages of cassava appears to be increasing.

***The Benchmark approach.*** RCMD is the lead division implementing the benchmark approach. There is no doubt that adoption of improved crop types, integration of crop sequences, adoption of IPM and use of food, feed and cover legumes can be effective in the benchmark areas. However, investment of staff and resources is very heavy, as the benchmark in the Cameroon humid forest area exemplifies, and the Panel has not been given a convincing explanation of the linkage between the descriptive characterisation phase and the determination of strategic research outputs. The concept relies on the assumption that technology diffusion can be scaled from the focal area. Comparisons should be made between the uptake rate of sustainable production systems and marketable products with benchmark areas and comparable areas outside. Before further development of the approach, the concept and its methodology needs to be defined in a prominent international publication, and shown to be of demonstrable effectiveness through identifiable, relevant outputs. The widespread uptake of a cash legume crop in the humid forest benchmark area might be one example of the success of the method.

As discussed in Section 2.2.2, the Panel questions the value of the benchmark approach as a scientific methodology, rather than as an operational tool which may have finite value and duration, unless this linkage between description and identification of strategic research-led solutions can be demonstrated.

***Integrated systems analysis.*** RCMD modelling work has focused on carbon and nutrient cycling, but this has not yet been integrated with dynamic pest and crop models. The recent move to record all field investigation results in a geo-coded data base (Project Management System), discussed further in Section 3.7.4, is an excellent initiative, that will provide for temporal as well as spatial trend analysis on selected attributes in future. As the result of an earlier staff appointment, IITA is now lagging behind other CG centres in operational GIS and remote sensing platforms needed to underpin the work in resource management. This deficiency is now being addressed through recent staff recruitment but could be taken much further. With the emphasis placed on the ecoregional approach suggested by TAC since 1994, and the adoption of benchmark areas as a key approach to resource management since 1998, the need to link crop health and growth predictive models to resource data and agronomic management systems has become urgent. This is elaborated further in Section 3.6.

Donor reluctance to invest in the area of agri-inputs in Africa has eased somewhat from the situation of the mid 1990s, and acceptance of the extent to which policy, infrastructural, economic and financial conditions act as disincentives to improving agricultural productivity in sub-Saharan Africa is increasingly acknowledged. IITA sees an opportunity to play a larger role in evaluating the relative effectiveness of different types and levels of intervention on productivity and poverty alleviation, which the Panel commends. Implicitly this may require IITA not only to work more closely with the international financial sector and the relevant Ministries of developing countries, as well as with NARS, but to encourage such a change in the CGIAR as a whole.

The Panel commends IITA for working closely at senior levels with the agricultural policy sectors of the regional and subregional networks, and encourages interaction with the international financial institutions to analyse inconsistent policies that are working heavily against the growth of the agricultural sector in SSA (Section 2.3.1).

***Post-harvest technologies.*** In a system-wide review, the CGIAR recognized the very low level of investment in this area (TAC Secretariat 1997) and the need to strengthen it selectively. IITA has invested approximately 3-5% of its budget in these activities since 1996 (IITA unpublished documents), which represented 20% of the total CGIAR investment in this area in 1996. In 1999, FAO also instigated a global initiative to strengthen the post-harvest sector (FAO 1999) in which IITA is collaborating.

It has long been recognized that starchy staples require post-harvest transformation to protect surplus production in these very perishable crops from classic boom-bust production cycles that impact so deleteriously on farmer income. This issue remains as relevant today as in the past. The demand for processed foods continues to rise steadily as urban populations increase. The Panel found Agricultural Ministries in both west and east African countries to have national plans for greater attention to the post-harvest area, both in stimulating the private

sector in food processing, and in market research, that endorse the work carried out by IITA in this area.

IITA has had notable achievements in technology development for a range of appropriate processing equipment for cassava products over a long period, both adapted to household and village scale, and those that have stimulated local manufacturing enterprises. IITA has also been a key organisation in the introduction and processing of soybean in West Africa (Osho and Dashiells 1998). IITA's role was to develop and demonstrate the uses of soybean in cooking oil, baby foods, supplement flour and animal feed over the past decade, in collaboration with major international and national programmes.

It is necessary to update the current extent of adoption of these processing technologies, and how much can be ascribed to IITA's efforts. There has not been an evaluation of this topic since 1996, when a CCER review strongly endorsed continued support for this area. They also expressed concern on the lack of a clear strategy for future work in Project 9 at that time, and the lack of consensus among researchers on priorities. Categories identified were product quality enhancement, processing and storage, product development and utilization, socio-economic research, training and institutional strengthening.

It remains unclear whether IITA continues to have a comparative advantage in all or any of the categories identified in the 1996 CCER. In the past five-year period there appears to have been a shift in emphasis from processing, storage and product development, towards socio-economic and market research.

Plans outlined in the MTP 2002-2004 thus place substantially greater emphasis on market demand and policy analysis. Post-harvest technology work is apparently being distributed among other projects, rather than located in a single project linked to market analysis. However, although this dispersion is commended by TAC, close examination of the MTP shows only three projects (6, 11 and 12) are conducting post-harvest technology development, and no details are given. It may well be that processing technology and product development needs can now be met adequately by the private sector or other institutions with greater comparative advantage in the region, but the Panel has not been provided with convincing evidence that this is the case. There is a clear need for IITA to identify what priorities should be placed on research at different points in the production-consumption continuum.

The Panel **suggests** that IITA commission a study by an eminent external consultant on where IITA's comparative advantage lies in further research on food processing, storage, or product development for different crops, and markets to guide the Centre, NARS and donors in this important area (see section 3.5).

***Quality of science/publications.*** Since the 4<sup>th</sup> EPMP, RCMD has increased its research publication output from a period of previous disruption. The CCER (1999) on different aspects of work in RCMD, expressed concern that not all IRS staff were active in publishing their results, and recommended that there should be a goal of at least one refereed paper produced per IRS per year. Over the last five years approximately only half the IRS staff have achieved this rate of publication. A quarter has been very prolific, accounting for 60% of the refereed papers.

The calibre of journals by citation index values is relatively low, averaging only 0.56, but this is not considered unreasonable for topics that focus on applied, field science. Nevertheless, there is an absence of those few, seminal publications that act as a stimulus to research objectives for a whole body of scientists by articulating core concepts. Seminal papers on AEZs, benchmarking and scaling-up for example, have tended to come from ARIs in Europe and America.

There is a very strong predominance of agronomic, soil biology and nutrient topics among the refereed journal and book publications. There have been very few publications on post-harvest technologies during the past five years, despite the apparent success of technologies and products attributable to work in IITA. Most of the economic and social studies on impact assessment have been published as in-house reports or monographs not into high quality international journals.

The Panel considers the publication record and range of topics covered are not commensurate with the proportional investment in staff and resources, or in the project range covered by this research area in IITA. The calibre of science required by international, peer reviewed publications serves a vital purpose in providing a measure of the internal rigour in validation of hypotheses being tested.

***Other performance measures of output.*** With an increasing amount of work in RCMD being carried out on-farm in a participatory approach, the argument has been advanced that impact is more realistically assessed by rate of uptake of IITA's technologies and socio-economic effect in addition to scientific publications. The Panel considers that performance of both scientists and the Centre's output should include a wide spectrum of relevant measures. Other performance measures are relevant to the broad scope of the work:

1. internationally accessible, quantitative data on change in land use, and crop production statistics for wide stakeholder use; (This has not been a feature of the outputs and is rated poorly.)
2. the extent to which genuine collaborative project planning and research has occurred with NARS; (This has been a growth area with excellent success. The Panel commends all those involved in this significant change in the level of interaction of IITA with its stakeholders.)
3. rate of dissemination of improved crop and resource management practices with demonstrable financial, social and environmental benefits; (Although impact studies were considered, the rigour of most needs improvement.)
4. software development, modification or application; (This has been an area of very low output.)
5. engineering blueprints, design modifications, and working prototypes of post-harvest equipment for which a substantial and credible number were produced are relevant measures for post-harvest engineers.

Overall, the quantity and quality of the scientific output is less than expected for a group that constitute nearly 40% of the core scientific operational resources of the Centre.

**The Panel recommends that RCMD develop a clear business plan for each of its project components; identifying clear outputs by expected time-lines that are substantiated by**

**peer-reviewed publications; and particularly with respect to the concepts and methodologies of the benchmark approach.**

### **3.4.3 Impact**

Impact from IITA's work to promote leguminous cover crops, alley farming and the integration of legumes with cereals has been evaluated internally in a series of small impact studies. This has been a valuable activity to assist donors in appreciating the benefit or otherwise of particular projects, but the studies have been limited in depth and do not provide a clear picture of the overall extent of IITA's influence (or the CGIAR centres working in Africa in general). It would be helpful to know the spatial extent and proportion of adoption of such systems as inter-row cropping of soybean and cowpea with maize and sorghum, the use of leguminous cover crops, and the furthest extent and then decline in the practice of alley cropping. Maps of areas targeted and distribution linked to population density or measures of household income would be particularly telling.

The recognition of failure, as well as success, in the adoption of sustainable resource management has been a valuable outcome of socio-economic analyses conducted by IITA in the past five years. For example, the reasons for slow and differential rates of adoption of alley-farming in Benin, Nigeria and Cameroon, based on published work, has established that abandonment of the system after initial adoption occurred primarily because of poor technical information services available from local extension services. Such findings reinforce RCMD's recent endeavours to interact with a wider range of technology transfer organizations, and to move to working in an on-farm participatory manner.

Another well learnt, costly lesson, is that low input systems without fertilizer have failed to provide adequate productivity gains in the resource-poor and degraded conditions that characterize much of sub Saharan Africa. Hopefully, the donor community that put great pressure on IARCs in the 1980-90s to concentrate on low input systems has also learnt this lesson. A recent scoping study on agricultural input markets in Nigeria by IFDC-IITA-WARDA (2000) provides an excellent start, cogently demonstrating the tight linkage between inconsistent interventionist policies in fertilizer production and distribution, seed and fertilizer use, and food production.

The Panel considers IITA, together with its collaborators, has a comparative advantage in identifying the drivers, cataloguing the current status, and identifying the positive and negative interventions of agricultural intensification in WCA. Such work, developed in a suite of major publications (both international scientific journals and public information documents) would be of wide benefit for use by all stakeholders in charting effective agricultural reconstruction strategies. The Panel's views on how to best integrate and analyse some of the biophysical and socio-economic components are considered in Section 3.6. Such an effort would be consistent with the strategic directions in RCMD's programme, at the same time as positioning IITA as a world authority on this critical issue.

**The Panel recommends RCMD lead a concerted effort to fully understand the driving forces, extent, rates and types of cropping system intensification in the major AEZs of West**

**and Central Africa (wet and dry savannahs and humid forest), using innovative approaches and appropriate partnerships.**

### **3.4.4 Future Directions**

RCMD's strategic vision has been modified since the 4<sup>th</sup> EPMD to take greater account of the increasing role of the market economy in improving agricultural productivity even in poor developing countries. In the draft 2001-2010 Strategic Plan more emphasis is given to whole farm systems, considering the full range of potential interventions, including downstream technologies and fuller integration of crop-livestock systems. The strategy's greater focus on intensification aligns much more closely with regional government priorities than the somewhat conflicting aims of breeding for more marginal (low nutrient, droughty, or acid) environments.

The Panel encourages much greater integration of the work across divisions in developing more sustainable cassava intensive production systems. Similar opportunities to improve the efficiency of production and sustainability of yam-based systems may be possible. Developments in production of unstaked yam, reduced mounding, and any other techniques that reduce the demand for planting material and labour, have the potential to increase production of this much-prized but under-researched crop. As yet there are few instances of resource and crop management research into these two major crops that visibly demonstrate the value of RCMD's contribution to the public good.

The draft Strategic Plan places less emphasis on basic process research in RCMD, except in the area of chronic weed problems (such as *Imperata* and *Striga*) and improving integrated nutrient utilization and efficiency. The Panel agrees with this general shift in emphasis, and indeed would suggest it could usefully change faster than actual research activities and publications indicate. The cost-effectiveness of conventional agronomic trials, such as those described in progress reports from the EPHTA benchmark areas, should be carefully re-considered (see Section 4.1.1). Within the EPHTA partnerships, some such work is possibly justified as part of capacity building, but continued investment by IITA on leguminous cover crop trials, animal manures, and crop residues would appear to be a case of diminishing returns.

The Panel **suggests** it is time to see a shift in emphasis to collating, analysing and applying these data from descriptive characterisation of domains, so as to speed up the selection of 'best bet' options to test, with the help of dynamic modelling (Section 3.6). Significant changes were made in 2000 to the number of projects, their objectives and planned outputs to align work teams and reporting procedures more closely with this intended shift in direction. Annex VI shows that all but one of the old projects that have been integrated into the new projects were in RCMD, and the only new projects (12, 13, and 14) are also in this Division. In short, while changes to CID and PHMD projects have been minor, RCMD is still characterized by major re-organization, as has tended to be the case throughout IITA's history.

The new projects 12 and 13 reflect the reality of the changing land uses in West and Central Africa. Project 12 recognizes the fact that continuous cropping is ubiquitous in high population density areas; research on fallows is therefore largely redundant, and must be replaced by the search for more sustainable, input-based systems. Project 13 recognizes that

continued destruction of the remaining forested lands through demand for agricultural enterprises will occur relentlessly unless financially attractive farming systems can be developed that use the forests *in situ* as a part of the system, and is researching opportunities for such alternatives. These changes in direction and operations by RCMD are welcome and constructive.

Until more rigorous and thorough evaluation studies are made to quantify activities in RCMD, it remains uncertain whether the large investments made by IITA in this area are having a significant effect on halting resource degradation, or contributing to total factor productivity gains. The present evaluation process is inadequate. At present it is not possible either for management or donors to assess whether the investments would be more effective in their present form or in capacity building, post-farm technologies, assisting in policy formation, or in some other area of activity altogether.

### **3.4.5 Overall Assessment**

The work in RCM has expanded since the 4<sup>th</sup> EPMP and is set to increase in proportion of budget in the MTP 2002-4. While the science is gaining some coherence and inter-disciplinary teamwork, there is still a mixture of past and present objectives. Greater clarification is needed on a more focussed set of objectives and the reasons for the benchmark approach requires better justification.

Work on impact assessments and policy analysis has commenced but can be improved. This is partly recognized in the expanded resources that will be put into this area, but is discussed further in Section 3.5.

The benchmark concept is set to become the main operational tool of the Centre with planned increased focus on the yet-underdeveloped AEZs. The Panel is troubled by the apparent emphasis on data collection and characterisation that has prevailed in the most developed benchmark area to date, without clearly articulated hypotheses or planned interventions. The need for a review is particularly necessary because the CCER review in 1999 was not charged with considering the merit of the benchmark approach, but focussed on the projects within the division.

The Panel considers there is a finite limit to the benchmark concept as a scientific approach, and it should be reviewed in its entirety, addressing the concerns expressed here and in Section 2.2.2, with a clear research plan developed for each benchmark area.

Re-organization of the projects following the 1999 CCER and the further restructuring in 2001, in line with the Draft Strategic Plan for 2000-2010, provide a more logical framework for the future work in this area. The 1999 CCER also recommended a shift in the balance of RCMD staff between the various stations, and increasing the proportion of economists and social scientists.

The Panel endorses the recommendation of the 1999 CCER to increase the capacity of sociologists and economists in IITA overall, and to alter the balance across the regional stations,

both by strengthening RCMD staff in Kano and Cotonou, and reducing the number in Yaoundé, where there is a need for CID/PHMD staff.

### **3.5 Social Sciences and Impact Assessment**

The Panel recognizes that social science is not a separate division but because it must play a critical role in IITA's research programme it is given separate treatment here.

#### **3.5.1 Social Science Capacity**

The 4<sup>th</sup> EP MR paid specific attention to the social science component of the research programme at IITA and recommended a significant increase of the number of social scientists. The EP MR commented that the number of social scientists was less than 10% of the staff of the Institute, compared to a CGIAR average of about 15%. The hiring of two further agricultural economists and an impact assessor with a related social science background was recommended.

Currently, there are eight social scientists (six agricultural economists, one rural sociologist and an impact specialist), including six in RCMD, one in CID, and one in PHMD, which compares with a contingent of six in 1995.

Despite this improvement in numbers, social sciences still face two major issues at IITA: a lack of coherence in the work undertaken, which results in *ad hoc* studies without a unifying thread; and the need for senior leadership to guide the work and promote its excellence.

#### **3.5.2 Work Programme**

The work during the period concentrated in two principal areas: characterization, and impact assessment and technology adoption.

The objective of the characterization research was to go beyond a descriptive, site-specific traditional farming systems approach to a more dynamic approach that combined geo-referencing with socio-economic surveys. The approach resulted in the delineation of representative areas (the benchmark areas) to serve as a basis for extrapolating research findings. A major hypothesis of the characterization work is that the stage at which a farming system operates determines the type of technology that can be introduced. Systems are described primarily as either population-driven or market-driven and whether in an expansion (low land-use intensity) or an intensification (high land-use intensity) phase. This two by two matrix gives four types of systems. Systems dynamics is determined by two factors: access to wholesale markets, and the existence of a major cash crop. The role of cash cropping and market infrastructure are strong in a market-driven and weak in a population-driven system.

A major output of this work has been the definition of research domains from which research findings could be scaled out. A sociologist's contribution helps to provide understanding of how farmers modify and integrate natural research management technologies during adoption in pilot sites. As a tool, the research domain may be appropriate for biological

processes, which are deterministic, but may fail to track human and social factors adequately. One disadvantage is the requirement of a substantial amount of descriptive data. Without a strong conceptual and theoretical underpinning, the value of this investment can be limited. Although the characterization process could have allowed the deeper understanding of socio-economic processes in relation to technology adoption, the methods used did not allow this output to materialize. Moreover, the rigor and validity of this conceptual model has, to the Panel's knowledge, not passed the test of peer review and publication in international economics journals. The Panel has reservations about the usefulness of the characterization scheme for future work. While it is interesting descriptive work, the lack of a clear analytical framework limits its contribution to IITA's research prioritization.

The second area of concentration has been impact assessment and technology adoption. The last EPMPR noted the absence of formalized impact assessment work at IITA, as the few references appeared to be anecdotal. Over the last five years, the Institute's output on impact assessment/adoption of technologies has increased. The Panel reviewed seven studies made available to it.

- One study looked at the impact of improved soybean varieties in Benue State, Nigeria, and found that the nutritional status of children had improved and that women were adopting and benefitting from the soybean almost as much as their male counterparts. The study explicitly used the social impact assessment model based on the diagnostic-diffusion-adoption-impact continuum of technology, a systematic way of incorporating socio-cultural factors in the adoption process.
- The evaluation of the impact of the biological control of the cassava green mite reports large increases in farmers' income in Ghana and Nigeria. The study uses an economic surplus model to estimate the net present value (which represents the net social gains) from the research.
- A study on the adoption of dual-purpose dry-season cowpea showed that adoption had led to improved food security and reduction in farmer risk through crop diversification and more cash income. The study builds on a simple frequency analysis of farmers' assessment of various benefits.
- The fourth study documented the importance of socio-economic and policy factors on the adoption of alley farming. Using a logit regression model, farmers' perception of erosion, the contact with extension agents and being a migrant positively affected adoption, while renting land and the existence of fodder were associated with lower adoption. A policy analysis matrix model showed that producing maize under alley farming was socially more profitable than producing maize with chemical fertilizer.
- The fifth study looked at the impact of IITA maize germplasm and documented a significant increase in maize production. The study evaluated that food security was improved for nine million people.
- The sixth study examined the dynamics and determinants of the adoption of *Mucuna* in Benin. The study used a probit regression model to show that the age of the farmer, contact with extension, land tenure security, soil fertility were associated with higher adoption. The study further showed that the use of *Mucuna* increased production through an outward shift of the production function.

- The last study reports the impact of IITA cassava varieties on food security. It was estimated that 14 million people benefitted from an additional 2200 kcal per year from the adoption of cassava.

The Panel notes that the Institute has bridged some of the gaps in impact assessment noted by the 4<sup>th</sup> EPMR. In particular, the number of impact studies has increased, and an effort was made to undertake socio-economic evaluation of technologies rather than concentrating on calculating rates of return.

In addition to these two main groups, the Panel noted several other studies including the analysis of horticultural production and marketing systems in southern Cameroon, the economic analysis of crop-livestock integration, the analysis of the competitiveness of agroforestry-based maize production technology for Cameroon, and the effect of market access on the adoption of new cowpea varieties by small-scale farmers in Nigeria.

Further work is planned on constraints to commercialization of crops and on marketing channels and consumer demand. With regard to demand studies, an urban component was completed for Nigeria and Cameroon in 2000, and a rural component is now being planned for these two countries. A proposed study of the input market in Nigeria has been submitted to USAID for funding. ESARC in Uganda has already initiated work in the area of market studies with the FOODNET project. As much of the marketing work is country specific, subcontracting with local research centres or entering into strategic partnerships with competent institutions may be the best strategy for IITA.

Interestingly, work on systems modelling is one area in which IITA social scientists were earlier involved but in which during the past five years they have not contributed on a sustained basis. Simulation models of crops, pest and natural enemies are already being used to assess the impact of various functions. For such analyses to be of value in a farm setting, the input of a production economist is a necessity (see Section 3.5.4).

### **3.5.3 Research Quality Assessment**

Assessing the quantity and quality of the contribution of social scientists is, at best, difficult. Moreover, the lack of a cohesive group of social scientists at IITA within an identifiable programme complicates matters further. The Panel's assessment of the quality of the social science work at IITA was primarily based on the number and the quality of publications from 1995 to 2000. From the publications made available to the Panel, several observations were noted.

First, the Panel is pleased to see the increased frequency of co-authorship between the social scientists and biophysical scientists and commends the group for publishing those articles in journals outside the economics field. The apparent increase in interdisciplinary work is in contrast to an earlier situation, (prevailing at the time of the 4<sup>th</sup> EPMR), when there was a lack of interaction and interdisciplinary nature in the project work.

Second, the total number of publications and reports, which include journals, book chapters, conference proceedings and various in-house publications, was considered below expectations for the group (IRS + post docs). There were only 14 publications in the peer reviewed international journals, which averages out to about 0.3 publications per scientist (IRS + post docs) per year over the last six years, a figure the Panel considers to be far below the norm. The precise reason for this low production rate is unclear but the Panel believes this is a serious issue and therefore strongly encourages the Centre to immediately address the following related issues: research capacity in social sciences (not just numbers); quality control processes at the divisional and Institute level; and, adequate incentives for publishing in international journals, particularly in the fields of economics and other social sciences. The Panel recognizes that most of the social scientists have joined the Centre within the past two years, and that several papers are still in draft form pending acceptance for publication. The Panel is also aware that some scientists had published in international journals before joining IITA. However, the aggregate publication record at IITA during the last six years remains below the norm.

Third, half of the 14 refereed journal publications came out during the first two years of this review period, i.e., 1995 and 1996, and the majority of these were authored or co-authored by IITA's most senior agricultural economist who left the centre in 1998. Of the remaining seven peer reviewed publications produced between 1997 and 2000, none were published in an economics-related discipline. The Panel reviewed these publications. In the Panel's opinion, the ones published during the first two years of the review (from 1995 and 1996) are of fairly good quality, using economic theory and appropriate methods to examine factors influencing adoption of technologies. The Panel, however, had some concern about the rigour of the economic theory and methods used in several of the articles published in the non-economics journals (e.g., *Crop Protection*, *International Forestry Review*, *Agroforestry Systems*, *African J. of Roots and Tubers*). This underscores one of the important reasons for targetting economics journals from time to time as a quality check. In addition, the Panel believes the social scientists at IITA have a role to play in generating international public goods type information, such as methodology development, policy analysis and basic understanding about social and economic processes.

Finally, many of the non-quantitative studies and reports of the group, particularly those lacking a theoretical background and sufficient rigour, lead to findings and conclusions that do not in themselves justify a sufficient basis for sound recommendations. The Panel simply wishes to highlight the need for IITA social scientists to plan and target their output for publishing whenever possible in journals of their respective disciplines in addition to (not instead of) the journals outside the fields of social science.

#### **3.5.4 Future Directions**

A common theme running through much of the discussion on strategy in Chapter 2 and in the discussions earlier in this Chapter on the biophysical science programme has been the lack of rigorous analysis in setting priorities. Better quality impact assessments, and their linkage with an understanding of the driving forces behind farmers' actual adoption of improved varieties and other technologies in SSA, are needed to assist the biophysical scientists with their conceptual and quantitative models of farming systems. This is the responsibility of the social science

component of IITA. There is a seminal need for socio-economic research capacity at the Centre commensurate with IITA's role as the leading agricultural research Institute in SSA.

The biophysical scientists have produced models of crop systems that provide estimates of farm productivity and, when put in a GIS, allow assessment of regional issues such as land degradation, technology adoption rates, biological control and IPM impact, and other issues. The social science discipline is required to incorporate an economic and sociological framework into these models, including production and price risk functions, markets, institutions and government policies. By using more realistic models of farmer behaviour, the social scientists will be able to assist in setting priorities for the research programme by providing, among other outputs, the probable impact of technologies with different characteristics and the likelihood of adoption by farmer category.

Effectively prioritizing the biophysical research programme calls for social science input in the following areas:

- crop improvement and plant genetics work in order to help extrapolate results of crop improvement and pest/disease interaction studies
- biological control and integrated pest management work, which has developed various simulation models, (incorporating GIS), and which could be used for region-wide ecological and economic analysis
- all resource and crop management activities, which are cast in a cropping system context that require an economic underpinning
- assessment of the relative economic importance of constraints to crop production; for example Black Sigatoka disease in plantain production; the *Maruca* podborer; the importance of irrigated conditions for cowpea production; and labour requirements during the yam production cycle.

In allocating scarce resources, the Panel believes it is important that the Centre pays particular attention to the comparative advantages inherent in a social science programme at IITA. These relate to the social scientists' close working relations with the biophysical scientists and their regional, as opposed to country specific, vantage point. For this reason the Panel suggests that the resources of the social science group should be focussed principally on three areas: complementing the biophysical scientists in systems modelling; effective ex-post impact assessment studies; and priority setting exercises.

In response to a recommendation by the 4<sup>th</sup> EPMR, the Centre has filled the position of impact assessor. However, the current position focuses on the process of adoption and diffusion of technology dynamics, rather than documenting the social and environmental impacts of adoption as suggested by the 4<sup>th</sup> EPMR. The Panel calls the attention of the Centre to the need for quantitative impact analysis. The study of the social impact of soybean in Nigeria's southern Guinea savannah is a good example of a case study that attempts to document the positive impact of an innovation on a number of social development indicators, including household income and distribution, material welfare, gender relations, resource use and social equity in the community. This provides a useful model for structuring future *ex post* impact studies at IITA.

The Panel believes, however, that studies of market behaviour are often so location-specific that IITA should be building strategic relationships with NARS which have a comparative advantage to undertake this work, if necessary facilitated by a subcontract from IITA. The FOODNET project in Uganda provides an example of such linkages.

**The Panel recommends that research capacity in the social sciences at IITA be strengthened, through two actions:**

- **appointing an eminent agricultural economist to provide leadership and cohesion to the socio-economic research activities; and**
- **ensuring representation of a senior economist on the Research Programme and Executive Committee (RPEC).**

The lead economist should be a specialist in production economics and have a strong publication record in international economics journals. It may be necessary to increase the number of scientists in this discipline to a similar level as that at other CGIAR Centres and that they be fully integrated into the AEZ and project framework. In addition, the social science group needs to develop more substantive links with CGIAR Centres with experience in SSA, including IFPRI, ILRI, and ICRISAT. This will be particularly helpful in the policy arena.

### **3.6 Geo-Spatial Analysis and Crop Systems Modelling**

*Geo-spatial analysis.* Advances in geo-spatial analysis (GPA) are proceeding rapidly and provide much greater capacity to analyse biological, social, economic and other kinds of data at various scales of resolution. Tools include:

- Geographic information system technology (GIS) for mapping and recombining various kinds of geo-referenced data (weather, soil properties, vegetation data, population, etc); and
- Satellite remote sensing that provides large-scale data on weather and other global factors (e.g. NOAA-AVHRR data) for exploitation at ecosystem (AEZs) and even larger scale levels.

While IITA already has informal links with Yale University, dialogue should be sought with universities and ARIs, such as the International Institute for Advanced Systems Analysis (IIASA), which focus strongly on coupled GIS-remote sensing applications for land use and population change. IIASA might be an important partner in extending IITA's current work to the sub-regional scale. In addition, several CGIAR Centres are engaged in developing GIS and some are part of the new CGIAR GIS initiative (Consortium for Spatial Information (CSI)). Of the IARCs, CIAT appears to have the greatest experience and infrastructure for GIS work<sup>7</sup>. IITA has had GIS capacity for quite some time but few tangible results are apparent. The current reinvigoration of the IITA group is a positive sign.

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<sup>7</sup> PHMD established early co-operative efforts with CIAT's GIS group for help in characterizing climates in different regions of the Americas and Africa to determine ecological homologues so that suitable areas for exploration cassava mealybug (CMB) and cassava green mite (CGM) natural enemies could be identified.

RCMD is gathering geo-coded sociological, economic, physical and biological data to characterize benchmark sites in different AEZs, and uses multivariate methods and dynamic models of vegetation productivity. Data are being collected at sites within a benchmark area along a human population gradient. The working hypothesis appears to be that the gradient is a surrogate measure of the cumulative effects of human management of land over time. More recently, RCMD has begun to use simulation packages developed by ARIs (e.g., the ROTHC, a Rothamsted Carbon model, and the Forest Land-Oriented Resource Envisioning System (FLORES)). The ROTHC model is used to examine changes in soil organic carbon at time scales of decades to centuries, based on information on quantities of organic matter returned to the soil, climate and soil characteristics. The FLORES model evaluates village-scale land use systems on fine-scale temporal and spatial resolution to examine the dynamic interactions between the biophysical and the human socio-economic components of rural communities living at the forest margin.

A *goal* of RCMD scientists is to examine the effects of land management on soil degradation and deforestation in a socio-economic context. Remote sensing has been used to determine the patterns of land use at the village level for characterization of benchmark areas. The 'working thesis' of this work is whether aggregate data can be used to explain the quantitative and qualitative changes observed in the land cover at defined temporal scales. Nearly all of this research is ongoing.

***Crop systems modelling.*** In collaboration with ARIs, PHMD scientists have developed physiologically-based multiple trophic models of various cropping systems that are weather-driven as modified by edaphic factors. These models are reviewed elsewhere (Sections in 3.3).

The combined use of geo-spatial analysis and physiologically-based models within IITA are highly compatible and, if combined, would jointly give IITA a competitive advantage in the analyses of agroecosystems at specific sites or on a regional level. The GIS shells and the embedded models would provide synoptic overviews of the components of whole-system interactions that have important applications for studies of the effects of climate change and socio-economic factors on crop production and protection, biological control and IPM. This system would also enable regional economic and weather-related crop risk analyses. This combination would provide an exciting and powerful addition to IITA's research capacity. The Panel **suggests** that IITA's GIS development include early discussions with relevant partners in biological and the social sciences in system design and development. IITA should also become an active participant in the ongoing CGIAR CSI initiative.

**The Panel recommends greater emphasis on the development of geo-spatial analysis capabilities within IITA, co-ordinated with other ongoing programmes in the CGIAR System and with appropriate ARIs.**

However, the Panel does not believe that IITA should become involved in developing large-scale system simulation software because of time, human resources and monetary constraints. The Panel **suggests** that such development, if required, should be done with major partnerships with ARIs with strong records in the relevant area.

## 3.7 Research Support

### 3.7.1 Information Services and Training

Information dissemination is carried out through publishing, public awareness, library services, and training. Recent emphasis has been on improving the quality of publishing and moving towards web-based approaches and using CD-ROMs. With the recruitment of a new head of Information Services, increased importance is being placed on public awareness, "getting the good news out on scientific advances in agriculture that are benefiting Africa's farming communities." The Information Services unit also assists financial staff for fund raising initiatives.

Increased attention to technological innovation in publishing has resulted in cost savings for printing and dissemination, and the ability to get information out both in greater detail and more quickly. Scientists are producing their own documents in a 'web-ready' format, eliminating a number of steps in the preparation process. An in-house Intranet provides access to information on finances, various Centre policies and guidelines, aircraft schedules and IITA rates of exchange.

The impact of widespread sharing of information is just beginning to be seen, but can be expected to speed up decision-making, achieve operational efficiencies, and weaken unnecessary organizational 'silos'. IITA is to be commended for leveraging off the technological knowledge of young volunteer (VSO) staff in order to move forward assertively in this new area of technology despite financial limitations. The IITA website was similarly developed rapidly in the past two years, enabling quick access to a large range of information including full text research reports and training materials.

The IITA strategy notes dissemination of research information as one of the Institute's four major activities. Information services are traditionally one of the highest ranked services an international agriculture centre provides (the other being capacity building through training). The library serves as the central reference library for materials on tropical agriculture in SSA because of the absence of a similar resource elsewhere in Africa. For the same reason, reading privileges are provided to all *bona fide* researchers.

Access to timely, current library information services have been severely constrained by lack of financial support, particularly in staffing. The Centre has decided that an internationally recruited librarian is not required to lead the library, but the nationally recruited staff are isolated from international library and information science current practices and innovation. As a result, the staff is not included in CG systemwide planning meetings often attended by IRS librarians. In the absence of other resources, a commitment to staff development in the form of exposure to the international agricultural library community must be made. Perhaps the creative use again of a volunteer appointment—VSO, Peace Corps, sabbatical or a recently retired sciences or development librarian could be identified.

An excellent review of the library was conducted in 1998, but few of the recommendations have been implemented, including those with no or minimal cost, such as shelving journals alphabetically by title or the establishment of a library users advisory group. Some basic databases and resources are now available in Ibadan, such as TEAL, CABI, AGRIS and a French tropical database, and have been placed on the Intranet, but do not appear to be available to outreach sites. An excellent web page, *Links*, has been created to provide a useful portal to information on the web relevant to agricultural research for development, but potential users do not appear to be familiar with it.

Scientists at outreach stations report experiencing inadequate or no library support. Current contents pages, and group SDI services seem no longer available to them, perhaps because these services are available on the Ibadan Intranet. Many are unaware that they could use the library, pointing to a need for library services to be included more emphatically in the orientation of new IRS to the Centre. In the future, Internet availability may reduce some of the isolation these researchers feel with regard to information, but reliable access to internet capability is not yet available or budgeted in the coming year, at all sites. For library services that are available, scientists need to be made aware of them, and target response times should be established and monitored for specific services. The library staff tries their best but this is not an agricultural library of expected international standards.

Capacity building through training is one of the four IITA activities noted in the IITA draft Strategy. A training unit supports the Divisions and Networks, which have primary responsibility for mounting group and individual programmes. The training function has recently been transferred in its reporting relationship from Information Services to the External Liaison unit, since training is a major contributor to the objective of strengthening national systems and as such needs to be linked to all other co-operative activities. Training incorporates:

- Graduate Research Fellows recruited from SSA countries to complete MSc or PhD studies at IITA.
- Group Training courses providing on-the-job training in the classroom, laboratory and in the field to groups of clients from NAROs.
- Individual Research Training Associates who are non-degree participants who come to IITA for specialized individual training.

Very recently, the Centre has begun planning a two-year pilot programme working with partner organizations (state agriculture and extension programmes, NGOs and educational institution) in Nigeria, using web and CD based technologies for distance learning.

Training has declined in terms of funding and the number of trainees, although the Centre has significantly contributed to building agricultural research capacity in SSA. Figures supplied to the Panel by the Centre show that a total of 239 postgraduate qualifications were completed between 1996 and 2000.

**Table 3.2 Graduate Research Fellows 1996-2000**

	1996	1997	1998	1999	2000	Total

PhDs	<b>38</b>	<b>29</b>	<b>30</b>	<b>30</b>	<b>20</b>	<b>147</b>
MScs	<b>16</b>	<b>19</b>	<b>19</b>	<b>15</b>	<b>23</b>	<b>92</b>
Total	<b>54</b>	<b>48</b>	<b>49</b>	<b>45</b>	<b>43</b>	<b>239</b>

Of graduate research fellows trained during the period 1996-99, almost half were from Nigeria, 11% from each of Benin and Cameroon, only 17% from all other African countries, and the remaining 13% were from Non-African countries. Based on data supplied by the Centre on the number of trained scientists within each country and the associated strength of NARS resources, the numbers being trained from each country are incongruent with the needs. Greater focus must be placed on recruiting persons from countries where capacity building is most needed. Women as a percentage of Graduate Research Fellows during the period increased from 21% in 1996 to 35% in 1999 (latest figure available).

In Panel visits throughout the region, it was apparent that there appears to be more of a problem of operational funding in the NAROs than with having trained staff, resulting in research scientists falling behind in modern research methods and concepts. Approaches to mid-career continuing education should be emphasized; this would also foster strategic partnerships and collaboration with NARS (see 2.3.2).

*Group training* has also experienced reductions in core resources and is largely funded through project and network budgets. Fifty-nine courses were offered to 1001 participants, with women averaging about one fifth of participants. The courses are taught by scientists and by the research-training specialist for the more generic ones.

**Table 3.3 Group Training 1996-2000**

	1996	1997	1998	1999	2000
# Courses	<b>19</b>	<b>14</b>	<b>10</b>	<b>8</b>	<b>8</b>
#Participant	<b>280</b>	<b>235</b>	<b>200</b>	<b>136</b>	<b>150</b>
% Women	<b>21%</b>	<b>18%</b>	<b>16%</b>	<b>18%</b>	<b>23%</b>
% Ibadan	<b>37%</b>	<b>29%</b>	<b>30%</b>	<b>38%</b>	<b>25%</b>

Despite the importance of training to IITA's mission and the demand for training from the NARS, the training function in some respects appears to be a stepchild in the Institute. It is now being moved in its reporting relationship for the third time in four years. In at least the past two years, no reports have been presented on this or on information dissemination to the Board. Given the reduced core funding in these areas:

**The Panel recommends that the Centre develop a specific strategy on information dissemination and training, particularly emphasizing mid-career scientist development for researchers from national programmes, even at the expense of some postgraduate training.**

### **3.7.2 Germplasm Health Unit (GPU)**

The GPU is in the PHMD Division. A 1993 meeting in Montreal, Canada set in motion the revamping of CGIAR Centre procedures on germplasm health that were formalized during a

1994 meeting at CIAT. The strong programme currently in place at IITA was begun in 1998 when new staff was employed. A consultant from FAO/IPGRI helped institutionalize appropriate procedures for screening germplasm for import-export and for field propagation. Germplasm may be seed, tubers, micro-tubers and tissue culture materials, and may be tested for the presence of viruses, bacteria, fungi, nematodes, insects and weed seed. After testing, the GPU unit certifies that the germplasm is free of disease, may recommend that it be cleaned further or that it be destroyed. On occasion, germplasm certified to be destroyed might be contested. In such cases, the GPU unit helps monitor its clean-up and further use in breeding.

The GPH unit is proactive, well managed and of high standards. IITA's influence is strong in Nigeria and Benin, but not in other areas of West Africa. It works closely with the Nigerian Plant Protection Service (NPS) which has the ultimate responsibility for the import and export of germplasm. IITA's procedures are in house but serves as technical backup for NPS whose staff is poorly equipped. Deteriorating national infrastructure is a weak link in quarantine enforcement and screening in West Africa. The Danish Government Institute of Seed Pathology for Developing Countries (DGISP) has trained many NARS staff in West Africa, provided supplies and books, and proposed that IITA become a regional centre for germplasm health. EPMP strongly supports this recommendation.

Databases exist on import-exports of germplasm by crop, country variety and date, but capacity for timely data summaries is still underdeveloped. Problem areas include conditioning and poor air circulation in laboratories, and service of the electron microscope.

### **3.7.3 Quarantine Facilities for Biological Control**

The 1996 CCER of PHMD and related Projects at IITA suggest that "The possibility of developing a biological control quarantine facility (containment) at Cotonou should be re-evaluated." The EPMP Panel strongly supports the IITA's position that under NO circumstance should a quarantine facility be established at IITA. The rationale is that alternative 'third country' facilities in northern Europe are available where the risk of accidental releases of pest organisms is small. This outweighs all other considerations. Biological control quarantine facilities require institutional stability, rigorous quarantine laws and procedures, and highly trained staff to assure unwarranted introductions. The same degree of caution should be exercised for introductions of all other biological materials, as described in the review quoted in Section 3.3.2.

### **3.7.4 Information Technology Support for Research, Bioinformatics, Biometry**

*Project Management System ('PMS')*. IITA has developed and implemented a comprehensive research data management system aimed at capturing all data recorded by IITA scientific staff. The need for a 'corporate memory' is important in all organisations, and nowhere more so that in the IARCs, where staff turnover is always high. 'PMS' is like a massive Laboratory Information Management System. This is a brave experiment with dynamic links to ICIS (the CG-wide crop information system), GIS data, the germplasm management system, SINGER (the CG-wide varietal trials system) and the main CIMMYT database for maize information.

'PMS' documents geo-referenced on-farm and on-station experimental field data, survey data and breeding data (genealogy of lines and screening results), and also administrative parameters of research activities. It is the intention of IITA management to enforce use of the system by all scientists. The Panel is impressed with the concept and will watch with interest as the project develops, as should all the other CG Centres. The Panel encourages IITA to continue to support 'PMS' and encourage line managers to insist that all staff use the system.

**Bioinformatics.** Bioinformatics is a growth area in biological research throughout the world. The sudden need to extract information from large datasheets emerged in response to massive amounts of data being released by technologies such as genomic DNA sequencing, genomics with chips and microarrays, proteomics and various new massively parallel technologies. IITA scientists are already manipulating DNA sequence data, and this will become more widespread as the arabidopsis and rice sequences become available. Also chip technology is not far away. Other Centres are beginning to bite the bioinformatics bullet, with all its attendant problems such as the high salaries bioinformaticists can command in industry, and are forming system-wide consortia with links to major groups in Europe and the US. IITA should consider forming a strategic alliance with an appropriate ARI in bioinformatics. In the not too distant future, the Centre may feel it necessary to develop a joint master's programme with a local university to ensure a steady supply of potential employees in this area.

### **3.7.5 Insect Biosystematics**

The 4<sup>th</sup>EPMR suggested that the biosystematics programme at IITA be strengthened, and in response, a small but strong proactive programme has developed. Strength in this area is absolutely essential to the maintenance of a viable programme in biological control. As part of the biodiversity programme, specimens from a broad range of cultivated habitats and life forms have been assembled in a central museum for cross-referencing, curation, and identification. IITA's reference collection on biodiversity is the most active and second largest in West Africa. Efforts have been undertaken to merge the collection checklist, the bibliography catalogue, the taxonomic list of West African insects and the single-specimen database into a global management and multi-user programme accessible to IITA scientists and their collaborators on a local network. The museum services requests by IITA and NARES scientists on taxonomic and related issues.

The demand to develop and sustain self-reliance in taxonomy and biosystematics in West Africa has been largely met through WAFRINET, which is node of BioNET-International. This system enables scientists from the sub-region to link with overseas centres having expertise in various taxonomic groups not available at IITA. The Panel commends IITA for its progress in establishing a strong group in biosystematics. The Panel recommends that because of its importance to biodiversity, and applied ecological sciences, funding for the core position should come from core funds.

### 3.7.6 Transgenic Crops and Biosafety at IITA and in the Region

IITA is responsible for providing leadership in the development of biotechnology applications including transgenic crops and biosafety standards for African agriculture. The Panel notes that IITA has already been hampered in carrying out field trials of their first transgenic varieties, black sigatoka resistant *Musa* lines. In the region, legislation is in place only in Uganda and Kenya. Although technically it should be possible for IITA to grow trials in these countries, the experience is that obtaining agreement can be expensive or take several years. It is of the utmost importance that appropriate measures are in place in Nigeria sooner rather than later. The Minister for the Environment appreciates the problem and is keen to move forward to ratify the guidelines being prepared with strong support from IITA. The Panel is pleased to see that a donor-funded meeting on biosafety is planned for May 2001 and hopes for successful conclusion by the end of the summer.

In the short term at least, it is unlikely that transgenic research will be incorporated into NARO breeding programmes. However IITA has an important role to play, not only in advancing research to overcome crop improvement constraints, but also in providing reliable information and advice to decision-makers in the region. Moreover, today, IITA's NAROs also have their own links with ARIs in developing countries. It is therefore vital that IITA take a proactive lead in the region in the dissemination of biotechnology information and training.

While training may not immediately be translated into improved breeding capacity, better informed scientists and administrators of the future will help resources being applied over time, and better informed breeders today will help progress a standard pan-SSA legislation and approach to release of transgenics in the region.

***Containment facilities at IITA:*** Containment facilities are available only at the main campus in Ibadan and are of variable quality. The Panel urges IITA to study the adequacy of these facilities for containment purposes (transgenic crop plants, airborne pathogens), and to improve and/or replace them as appropriate.

### 3.7.7 IITA and Intellectual Property

IITA has considered its IP position carefully over the years. It developed its first policy statement in 1992 and has revisited this document in 2000 and again in 2001. Moreover, following a scoping report by Michael Gollen of Venables, IITA, in September 2000, commissioned a wide-ranging external review to carry out an IITA IP audit, review third party IP currently in use at IITA and identify the actions needed to develop IP management guidelines in future. The Panel found this Audit by Carol Nottenburg of CAMBIA to be an excellent entry into IP culture.

***IP and IITA today.*** Potentially vulnerable practices ongoing at IITA were identified. Some actions are needed to implant an infrastructure that would allow future IP policy to be effective and adhered to. The Panel endorses that IITA should do the following:

- ensure that all future agreements, MTAs, MOUs, contracts etc., are issued through one office on behalf of the Centre (rather than individual scientists) under only designated signatures. This notwithstanding that initial negotiation may have been initiated by individual scientists – the Panel has no wish to stifle individual enterprise.
- ensure that these are all databased. The PMS database would be an ideal repository.
- ensure that all plant germplasm held at the genebank (collected before 20 Oct. 1994 or otherwise where it was clearly collected - following CBD and CGIAR protocols thereafter, with a view to making it available to all bone fide users) be clearly classified as "FAO-designated" or "non-designated".
- use CGIAR-FAO agreed material transfer agreement (MTA) for designated germplasm leaving the centre and develop its own MTA for other research products (e.g. improved breeding or genetic materials), insects, bacteria and other biocontrol agents.
- use CGIAR-FAO agreed standard germplasm acquisition agreement (GAA) to govern all future germplasm collections, and develop its own GAA for breeding and genetic materials, insects, bacteria and other biocontrol agents obtained from research partners elsewhere.
- clarify its 'freedom to operate' with all genes, constructs and technologies being used in research at the Centre. Research using a technology under conditions that will preclude its eventual dissemination to the IITA user community would be a waste. This is an activity, which it may be best to solicit from a CG 'System-wide' body such as CAS, since individual genes and technologies are very likely to be needed by several Centres.
- regularize software use at IITA. Ensure that all software is registered centrally.
- establish an IP Committee to determine, sustain and regulate IITA's IP activities.
- ensure that all scientists working at IITA, in whatever capacity, understand that their research and the products of their research belong to IITA.
- follow policies established by the Genetic Resources Policy Committee and the Centre Directors Committee/Centre Board Chairs of the CGIAR.

During the Nottenburg review, a database was initiated which contained: i) technologies in use at IITA that could have third party restrictions; ii) discoveries made at IITA which could form the basis for patents with application elsewhere; and iii), research products from IITA which could be protectable. This information will be vital for IITA when negotiating with collaborators and other third parties in defining 'background art'. The Panel suggests that this database, particularly 'invention disclosures' be maintained. Possibly a 'technology audit' could be a proscribed component of the Annual Staff Review process.

Other implementations could be used to bring about the shift towards a culture of IP awareness. These include a more rigorous laboratory notebook regime, the establishment of a Register of Conflicts of Interest, more IP awareness training for present staff and possibly inclusion in the staff and visitor induction process.

***IP and IITA tomorrow.*** As mentioned above IITA is reviewing its IP policy at this time and has begun to reformulate its guiding principles. At present the Board are being asked to consider a document that outlines a position in the moral high ground – that IITA will not patent, and that it will not allow others to make money from IITA IP. The Panel notes that IITA does allow that 'such protection' could be deemed necessary in some circumstances, and expects that management will continue to revisit their position taking on board some of the new guidance

material that is available. This will include: the Report of CGIAR Panel on Proprietary Science and Technology (SDR/TAC:IAR/98/7.1); recent EPMR recommendations for other Centres, and other Centres' new IP policies, and; documentation and advice available from the Central Advisory Service (CAS) of ISNAR.

The situation in Africa, and Nigeria in particular, is exceptional relative to other Centres. Biotechnology discoveries and technologies are generally not protected in Nigeria. Moreover, the potential interest of the multinational breeding companies in IITA's mandated crops is far less than, for example, with wheat and maize at CIMMYT or rice at IRRI. Nevertheless, a near future can be imagined where a more flexible attitude to IP negotiations might be more appropriate to IITA and its mission

The CGIAR Panel report and recent Centre IP policies indicate that other Centres are becoming less dogmatic with regard to IP. Consider the reasons that advanced academic centres in the North are increasingly protecting their discoveries and the products of their research; i) to effect more rapid transfer of their discoveries to the consumer; ii) to ensure that the IP is used in the most appropriate way; iii) to build a portfolio that can be used as collateral in future collaboration; and eventually; iv) to build an income stream to compensate for dwindling public funds.

At first glance, these reasons may not appear applicable to IITA. However, this goes beyond the improved germplasm for use in SSA alone. IITA biotechnologists might produce technologies of generic application; IITA's existing germplasm may become the focus of allele mining research where the products can be applied in any crop; IITA's preferred partners in future collaborations may not wish to work without the opportunity to protect their discoveries, IITA may even wish to 'spin-out' a company to more efficiently carry out a service, and so on.

Undoubtedly decisions will be made on a case-by-case basis. Certainly income to the Centre should not be a driver. IITA will at all time continue to be guided by its commitment to serve the resource poor. However considerations of prior art, access by users, avoidance of 'blocking' patents, collaboration with companies to effect efficient transfer to the resource poor, negotiating agreements to access proprietary technologies of others may be legitimate drivers in the not too distant future.

All such decisions will of course consider market segmentation issues so that the technologies may be offered freely to IITA's stakeholders in developing countries.

**The Panel recommends that IITA act now to fully implement its new IPR policy, namely:**

- **ensure that it has freedom to operate (FTO) in its present operations;**
- **put in place an infrastructure to ensure that all future IP issues be monitored and databased;**
- **ensure that IITA's IP policies effectively cover its designated germplasm, breeding products, publications, databases, trademarks and proprietary technologies; and**
- **periodically review the IPR policy in the light of evolving international regulations and conventions.**

IITA should also be keenly aware that activities at individual Centres can lead to difficulties at others (M.Blakeney's IIRRI IP stage II report). Its IP committee should regularly consult CAS on any consequences of its actions. CAS is also charged with developing a corporate knowledge for IP dealings within the CGIAR, particularly with industry and with NARS. IITA should ensure that it avails itself of this knowledge.

### **3.7.8 Other Research Support Services**

IITA has a substantial capital investment in large analytical and preparation laboratories for soil and plant sciences at Ibadan, together with a number of specialist facilities for biotechnology and germplasm conservation. The Ibadan campus also retains a suite of long-term field experiments, and trial sites, an arboretum, shade houses and greenhouse facilities. Substantial technical support infrastructure and facilities are also available at Cotonou, Onne and Yaoundé, with more modest facilities at Namulonge and Kano.

Operating conditions are adequate for the types of laboratory science conducted in most cases, although infrastructure is generally old. Ibadan currently faces substantial future plant renovation expenditure if it is to maintain functionality, particularly in electricity and plumbing replacement. Of more concern to the Panel is the question of whether the current facilities devoted to routine analytical services are of a standard that today's scientists should expect, – in automation, continuous processing and rate of through flow in order to conduct analytical and diagnostic work efficiently. Many methods employed still depend on wet chemistry, and the Panel heard of concerns with supplies of laboratory standard compressed gases, water quality, and the like. Unless the Centre considers winding down most soil and plant analysis work in future, these deficiencies will require investment.

## CHAPTER 4 - PARTNERSHIPS AND LINKAGES

### 4.1 Ecoregional and Systemwide Programmes

IITA is the convening centre for two CGIAR Systemwide Programmes: the Ecoregional Programme for the Humid and Subhumid Tropics of Sub-Saharan Africa (EPHTA); and the Systemwide Programme on Integrated Pest Management (SP-IPM).

#### 4.1.1 Ecoregional Programme for the Humid and Subhumid Tropics of Sub-Saharan Africa (EPHTA)

Ecoregions were adopted by CGIAR as its major approach to natural resource management interventions, characterized by both ecological and socio-political boundaries. The CGIAR sees the ecoregional approach as a mechanism to achieve joint research and extension effort by international and national institutions in a participatory manner with local farmers, NGOs, and other stakeholders in a partnership framework (CGIAR, 1999).

EPHTA was initiated by IITA through a recommendation from TAC to the CGIAR, following a SPAAR Technical Consultation in 1993. Three ecoregional consortia were agreed to: WARDA became the co-ordinator to the Inland Valley Consortium in 1995; the Humid Forest Consortia and the Moist Savannah Consortia were launched in 1996, with nine and six representative countries respectively signatory to a MoU with IITA (EPHTA 1996). Much was originally expected from this programme, which aimed at generating greater collaboration among NAROs and other partners such as NGOs and farmer groups. EPHTA is implemented under the umbrella of CORAF/WECARD. Policies are determined by a committee, which provides administrative and financial oversight and co-chaired by the DG of IITA and the Executive Secretary of CORAF.

The goals combine solutions to rural poverty and resource degradation, with mechanisms for stakeholders to work together across the region. The fifteen collaborating countries have identified six benchmark areas to work on within these two agroecosystem zones, more recently described as agroecological zones (AEZ). AEZs are now incorporated into IITA's core strategic directions. The benchmark areas are listed below in Table 4.1 with their current status (EPHTA 2001):

**Table 4.1 Benchmark Areas by AEZs in EPHTA**

<b>Humid Forest</b>	<b>Status</b>	<b>Moist Savannah</b>	<b>Status</b>
Forest margins	Characterization complete, IITA has strong presence	Northern Guinea savannah, Zaria	Characterization complete, local activity
Forest pockets, Ghana	No benchmark site set up yet, limited activity	Southern Guinea savannah, Côte d'Ivoire	Not active, no benchmark site activity

Degraded forest, SE Nigeria	Characterization complete, local support active	Derived, coastal savannah, Benin	Characterization ongoing, some local activity
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IITA has developed the benchmark approach to implement the ecoregional programme as a way of maximising the limited resources available both to country participants and the IARCs (Brader, 1998). National agricultural, research and extension ministries and organizations of all participating countries intended to support in-kind contributions to the network. It was expected that international donors would contribute to the system-wide ecoregional initiatives. Neither of these hopes has come about, and some proposals for donor support have failed (e.g.: an application to the EU in 1999). Limited international funding has been forthcoming from Denmark, Netherlands and France, but the lack of secure, ongoing international funding and adequate national support continues to hamper progress and casts a question mark over EPHTA's future. IITA has had to subsidise the consortia to a greater extent than anticipated, to the current amount of US\$1.59 million.

***Evaluation.*** IITA considers that EPHTA has been a useful initiative and remains committed to it in the new draft Strategic Plan and the MTP. Outputs to date include:

- a genuine collaboration between institutions, across country boundaries and with the Centre, with a set of six priorities agreed;
- a rationalization of resources across country boundaries, with only six benchmark areas in which work is conducted, selected from among 14 countries; and
- Capacity-building through participatory research, benchmark characterization, and technology dissemination by partner countries.

The momentum generated by the adoption of the benchmark concept by all participating organizations would make it difficult to withdraw from it at this stage. However, lack of funding has become a most serious constraint, and will restrict future effectiveness unless it can be overcome. At a recent workshop co-ordinated by ISNAR (March 2001), all ecoregional programme co-ordinators agreed that lack of donor funding was their most serious constraint. This situation reveals a common weakness of the CGIAR System in which a novel approach is instigated that later becomes unattractive with donors, leaving centres exposed and their partners disillusioned. While the ecoregional focus is giving way to the adoption of an AEZ framework for IITA's own core activities, the Centre is left with the need to devise an exit strategy from the grander vision that first generated so much enthusiasm among its country partners.

The Panel **suggests** that the review of the benchmark approach recommended in Section 3.4 include an examination of how IITA could sustain the positive effects of EPHTA within a constrained budgetary environment and options for an exit strategy.

#### **4.1.2 Systemwide IPM Programme**

Integrated Pest Management (IPM) (Section 3.3) is a keystone in the array of crop production technologies. The CGIAR Policy Statement on IPM asserts that it has a key role to play in sustainable agricultural production and should be the preferred plant and animal health

protection strategy of farmers world-wide. The CGIAR established SP-IPM in 1995 to foster open international co-operation between CG Centres and NAROs with the goal of developing “research Centres without walls” having as objectives the solution of system wide and/or large regional IPM problems. In this context, SP-IPM could be viewed in the context of the ongoing CG system discussions to strengthen inter-Centre initiatives via proposed global challenge programmes. Twelve SP-IPM projects were proposed but only three received donor-funding. IITA became the co-ordinating centre for the SP-IPM, housed its Secretariat, and managed one of the three projects, the Parasitic Plant Management Project in Africa (SP-IPM/PPM). In this review, IITA’s co-ordinating roles of SP-IPM and its management of SP-IPM/PPM are reviewed.

***Evaluation of IITA’s Management Role.*** Until recently, the SP-IPM Programme was led by IITA’s Director General. While this gave the project a high administrative profile, the challenging task of organizing and developing the programme fell on the SP-IPM Secretariat. The ToR of the Secretariat were those of a facilitator, advocate, consensus-builder and organizer. A high degree of technical competence in ecology, ecosystem science and systems analysis were required to organize and co-ordinate scientists of diverse technical backgrounds into effective projects. The process was made more difficult by uncertain funding, centre independence, and scientist self interest. The concept of a *centre without walls* was foreign to the thinking of most co-operating IARCs where strict accounting by project is the norm. The placement of the SP-IPM Secretariat position deep within the hierarchical structure of IITA further limited its flexibility and effectiveness. Recently, leadership of SP-IPM passed to IITA’s Director of PHMD, the original SP-IPM Secretariat left, and a replacement was appointed.

The SP-IPM Panel suggested that IITA reconsider its appointment of the SP-IPM Secretariat in light of the requirements of the position. The EPMP Panel concurs with this suggestion.

The IITA led SP-IPM/PPM was started in 1999 in response to the severe constraints on maize and cereal production posed by species of the parasitic flowering plants (*Striga* in Africa and *Orobanche* in West Asia and North Africa) and maize stem borers in several areas. Six pilot sites were established to implement *best-bet IPM technologies* in different agroecological zones. The SP-IPM Secretariat played a crucial role in the organization and implementation of the project, and the development of the methodology. The project established a common model for encouraging IPM adoption despite the fact that the characteristic of the sites including social, biological and biophysical factors required different best-bet options. Farmer participatory research methods were used and adoption of a common model allowed comparisons across sites. Despite meagre funding of US\$ 30 000 per site, most objectives of the SP-IPM initiative were met; especially the formation of a collegial centre without walls research environment.

At the IITA-led Guinea Savannah pilot site in Northern Nigeria, farmers implemented various trials on *Striga* tolerant maize varieties, inter-cropping of maize with *Striga* suppressing legumes, rotations of *Striga* stimulant legumes followed maize varieties, and double cropping strategies. The results suggest significant gains in maize yield due to *Striga* suppression, increased food security from early maturing cowpea varieties, increases in soil fertility and the potential for added income from seed multiplication.

PHMD was also a partner in the CIAT led SP-IPM Project on Sustainable Integrated Management of Whitefly (WF) as Pests and Vectors of Plant Viruses in the Tropics (SP-IPM/WF) project and the impact was impressive. WF-vectored cassava mosaic disease reached pandemic proportions in Uganda, Kenya, and Tanzania and raised the spectre of famine in the area. IITA resistant varieties were available to resolve the virus component of the problem. Ongoing agroecological studies will be required before a full IPM package can be implemented.

The SP-IPM Panel commends the Secretariat's organizing and oversight of SP-IPM activities. The critical March 2001 self-appraisal of the SP-IPM/ PPM task force recommended improvements in FPR methods and linkages among sites as well as limiting the number of sites based on agreed performance guidelines. The SP-IPM Panel viewed this as evidence of strong group commitment to the goals and philosophy of SP-IPM. The EPMR Panel concurs.

## **4.2 Linkages with Other CGIAR and Associated Centres**

There are a large number of collaborative activities with other CG Centres, which are listed in Annex VII. The Panel solicited responses from their DGs on the value and effectiveness of these activities, and found that they were uniformly supportive. Some of the most striking activities that should be particularly commended are:

- Several projects with CIAT on the collaboration of cassava germplasm with resistance to cassava mosaic virus, biological control of green mite and improved quality characteristics. The collaboration has been extremely productive, and is widely acknowledged and applauded by African partners.
- CIFOR-IITA and ICRAF-IITA collaboration on Alternatives to Slash and Burn (ASB) in Yaoundé, as part of the Systemwide programme. The DG of CIFOR considered this to be one of the best instances of inter-Centre collaboration in his experience.
- ILRI-IITA-ICRISAT projects on improvements in, and farmer evaluation of, crop-livestock systems, which has won praise among farmers and country partners in the dry savannahs of West Africa.

The Panel commends the Centre on its efforts to foster inter-centre activities within SSA. A rather lower level of interaction has occurred with some of the CGIAR-associated Centres working in the region, such as IFDC and ICIPE, where some collaboration has been undertaken, but more rarely than expected from their locational proximity.

Discussions have been ongoing for some time to explore ways of integrating research activities in SSA in the two sub-regions of West and Central Africa (WCA) and Eastern and Southern Africa (ESA). These discussions have included a significant amount of preparatory work by IITA in conjunction with WARDA and ICRISAT, which have already established ways to harmonize a number of administrative and operational functions. On the wider scene, all CGIAR Centres and their partners are committed to the integration of research activities in SSA.

A recent paper circulated for the upcoming Mid-Term Meeting( MTM) in May 2001, Durban, outlines the current thinking resulting from FARA-CGIAR consultations (CGIAR 2001). IITA and ICRAF are charged with the responsibility for facilitating progress towards centre integration, and co-ordination with the SROs, in WCA and ESA respectively. Integration processes are at different stages and reflect different conditions and cultures, but potential areas of co-operation in research and administrative support are already identified, on the basis of thematic areas. Inventories of centre activities have been prepared across all centres in each region to identify gaps, synergies, overlaps and complementary areas. The Panel notes that IITA's leading role in this process of integration will be a priority for the new DG.

### **4.3 NAROs and NGOs**

Members of the Panel had the opportunity to meet a number of senior members of host country Agricultural Ministries and Research Institutes.

#### **4.3.1 Host Country Relationships**

*Nigeria:* Members of the Panel met the Permanent Secretary and Directors of divisions to the Ministry of Agriculture and the Special Advisor on Food Security to the President in Abuja. Our very free and wide-ranging discussions indicated that excellent relationships exist between IITA and the Nigerian government. The DG has very close working relations at the highest level of the Government, which is reflected in his periodic meetings with the President. The Panel considers that maintaining these close ties will be a high priority for the incoming DG.

IITA has maintained good relationships over recent periods of significant internal change in Nigeria. Relations with the Federal Government of Nigeria continue to improve both on a formal and informal basis. Nigerian government priorities in agriculture can be given close consideration through this representation, and Nigeria made a contribution of US\$ 1,049,567 in 1999 and US\$ 997,091 in 2000 to the Centre, demonstrating genuine support.

*Benin:* The Panel met with representatives of the Benin Scientific and Technological Research Centre, Institut National de Recherche Agricole de Bénin (INRAB), and Université Nationale du Bénin, École d'Agronomie (UNB/FSA). Collaboration with IITA is judged satisfactory, but some fine-tuning is needed in the area of transferring more responsibility to the NARS that explicitly recognizes the value/level of the scientists within the NARS as equal partners.

*Cameroon:* IITA's Humid Forest Ecoregional Centre is located at Nkolbisson, outside of Yaoundé, adjacent to the main offices of the Institut de Recherche Agricole pour le Développement (IRAD). IRAD's regional priorities are identified through advisory committees. IRAD provides input into the Ministry of Agriculture. IITA and other IARCs are represented at these activities by the head of station. IITA is a full member of the regional priority-setting committee and the scientific committee for national collaboration.

*Uganda:* The Panel visited national Ugandan research institutes and the Ministry of Agriculture. IITA appears to have excellent and close relationships with these institutes and the

Ministry. Many East African agricultural specialists have been trained in postgraduate work with IITA, and have strong personal ties to the Institute and individual scientists. Such training activity is strongly supported by the national agencies, and there were requests for further consideration that IITA extend this to other disciplines, such as soil and plant nutrition.

### **4.3.2 Regional and Subregional Organizations**

The region has three active sub-regional research organizations of NAROs. These organizations have stimulated their members to develop national agricultural research strategies to develop strategic plans and priorities for regional research programmes. The three apex research bodies are CORAF/WECARD (West and Central Africa), ASARECA (Eastern Africa), and SACCAR (Southern Africa). They have constituted FARA, the Forum for Agricultural Research in Africa. Members of the Panel were able to meet the heads of FARA and ASARECA. The IARCs have established varying degrees of collaboration with CORAF/WECARD, and ASARECA and IITA has signed a Memorandum of Understanding with CORAF/WECARD, spelling out the responsibilities for the development and implementation of regional projects. A number of regional networks also exist, and in some cases predate the sub-regional ones, which in some cases identify areas of comparative advantage in different disciplines, with some division of labour and financial support for jointly agreed work.

### **4.3.3 Links with NAROs**

IITA's comparative advantage in sub-Saharan Africa is that it has established a critical mass of quality research capability, both basic and adaptive, which is unique in the region. Unfortunately, collaboration with national research programmes and institutions has become increasingly difficult over a long period because of consistently declining funding to NAROs despite the continuing importance of the contribution made by the agricultural sector to GDP, and fact that most of the region's population still live in rural areas.

Close collaboration is maintained between various research institutes and universities with IITA. Those at Amadu Bello University are an example. The University owns the land and buildings that house IITA's research staff and facilities at Kano, collaborates closely in the northern Guinea savannah benchmark activities from a basis at Zaria, and has a number of post graduate students studying and being supervised in IITA at any time.

Although the number of qualified researchers in the NAROs has increased in some countries over the past decade, government expenditure per researcher has declined in nearly all countries in sub-Saharan Africa. If present trends continue, the future looks bleak indeed. At the same time, national and provincial extension services have been poorly maintained and are demoralized. IITA and its NARO partners both recognize the value in broadening the range of stakeholders who can assist in technology and information transfer in today's changing environment.

### **4.3.4 Networks**

The increased availability of Internet linkages provides IITA with an opportunity to put in place cost effective networks between scientists working in the region and outside. This is particularly helpful in a continent with difficult communications and furthermore can provide a forum for IITA scientists to interact with collaborators in NARS and ARIs.

A number of such networks already exist in which IITA plays either a leading or important role, which is a very positive development. These are research networks in all of which the linkage to IITA is an important ingredient. The Semi-Arid Food Grains Research and Development (SAFGRAD) project spawned the West and Central Africa Maize Network (WECAMAN). The West and Central Africa Cowpea Network (RENACO) has now developed into PRONAF and incorporates PEDUNET, the network for cowpea IPM. The Southern Africa Root Crops Research network (SARRNET), the East African equivalent (EARRNET), the Soil and Plant Analytical Laboratories Network of Africa (SPALNA), FOODNET which focuses on post-harvest issues, and the Pan-African *Striga* Control Network (PASCON) all function on the internet and IITA scientists are part of each system. IITA has taken the lead in establishing the network BioNet that provides systematic backing for biodiversity work. All the networks function on the same lines as WECAMAN, which has a steering committee that meets once a year and in the intervening period work on the development of sustainable seed production and maize research development continues through the internet link.

#### **4.3.5 NGOs and Farmer Groups**

**NGOs.** Over the past five years, IITA has considerably strengthened and extended its linkages with a range of NGOs and farmer organizations. Host country NAROs and agricultural ministries are occasionally sensitive to this development when they construe IITA as acting without adequate consultation but these incidents appear to be isolated on an individual level. Good relations and maintenance of open communication channels between IITA and host country organizations appear to minimise such concerns, and the increase in the number of technology and information transfer mechanisms is welcomed.

Partnerships with some NGOs are particularly noteworthy. IITA has links with NGOs focussing on improvements in agriculture and food programmes. Sasakawa Africa Association (SAA) and Sawakawa-Global 2000 (SG 2000) are among the most active. Their programmes in Africa include dissemination of agri-processing technologies, and field demonstration of improved crop technologies to small farmers. Co-ordinators are seconded from Ministries of Agriculture or agricultural development programmes and work as facilitators between IARCs, NAROs and government extension agencies. The mode of operation encourages farmer-to-farmer adoption and training which is efficient and empowering. Agricultural credit schemes form an integral part of the inception stage in the programme. There are great advantages for IITA to work through such organizations.

World Vision International is a large NGO operating in most countries in Africa at the village level, across a range of programmes. They collaborate with IITA in IPM work in Ghana, Mali, Uganda and Mozambique to control cassava green mite, and there and elsewhere they act as disseminators of improved IITA crop varieties, involved in planting material multiplication and distribution.

IITA also works closely with a number of religious NGOs, such as the Diocesan Development Services (DDS) and Catholic Resources Centre (CRC) in Nigeria, which connect with very large numbers of farmers. DDS serves some 250,000 farmers and has been collaborating with IITA since 1972. DDS is a member of IITA's electronic cover crops network (CcropNet). CRC, based at Kaduna, assists over 50,000 farmers in northern Nigeria, and RCMD has been working with them since 1996. Other NGOs with which IITA interacts include the Green River Project of the Nigerian-Agip Oil Company, and the Rotary Foundation.

The degree to which IITA's impact is effectively transferred through the NGO connections is not readily assessed, as no impact studies have been conducted. This would form an interesting study. The Panel congratulates IITA on identifying and developing linkages that have the potential to expand the diffusion of tested technologies and information more widely.

***Farmers' Associations and Groups.*** Although not as strong as in other developing regions, farmer organizations are emerging as an important partner for IITA. Where they exist they appear to play an important role in farmer-to-farmer adoption mechanisms and feelings of empowerment, particularly in the case of women's groups. The Panel had opportunity to meet representatives from some of these groups in Kano, Yaoundé and Kampala.

There was a striking similarity in their priorities and concerns. These include ways to establish or access alternative small loan and credit schemes, concerns over improving marketing arrangements, and market information, together with increasing food processing for urban markets; however, many groups struggle with the problems of small or erratic supply. While IITA's assistance in the area of product development is often requested, the inadequacies of supply-chain infrastructure make it difficult for IITA alone to service such demands.

#### **4.4 Links with Advanced Research Institutes (ARIs)**

IITA derives considerable benefit from relevant third party funded interactions with ARIs. Links with scientists in universities and research institutes in developed countries provide critical mass in under-resourced areas, allow IITA scientists to keep up to date, and provide additional restricted funding.

According to data provided by the Centre, there are 41 such linkages, 23 of which are with PHMD scientists, reflecting on the remarkable successes in biological control systems generated by IITA scientists over the past 15 years. An excellent example is the DANIDA and DFID funded work on cassava mosaic epidemiology, working in close collaboration with NRI in the UK. Another 13 links are in biotechnology, including the well-funded Gatsby Charitable Foundation links with the John Innes Centre in the UK (US\$638,000 in 2001), and the Belgian government's funding of Black Sigatoka resistant transgenic plantain in collaboration with the Katholieke University, Leuven. This university also collaborates with IITA in a significant programme of over US\$ 1 million from the Belgian Government on nutrient management for sustainable maize production with scientists in RCMD.

While relevant collaboration boosts low unrestricted core allocation, there is one area of concern. Overhead recovery is very small, and certainly not at the levels commonly found in ARIs in the developed world. In IITA, overhead charges are running at an average of 9% of the cost of projects from restricted funding, as opposed to the computed overhead charge for the Institute of 23%. The Centre is clearly subsidizing these interactions significantly. The Panel believes that it is vital that IITA control and direct linkages (EPMR 1990 and 1996) rather than accepting proposals from outside in an opportunistic fashion.

Overall the Panel was impressed with the breadth of the associations between IITA and ARIs. It is hoped that IITA will move closer to a fully economically funded situation with its links (no ARI would accept the low overhead levels being achieved here). This will become ever more critical when funding levels begin to impact on IP arrangement with future commercial partners.

## **4.5 Private Sector**

### **4.5.1 Seed Companies and Input Suppliers**

IITA maintains informal collaborations with the Nigerian seed sector in the moist and dry savannah AEZs. The seed sector has a formal (mainly maize) and an informal component (mainly legumes). The formal seed sector currently includes the public seed agencies and five private seed companies. They sell certified seed of OP maize varieties and hybrids released by the National Seed Service (NSS), mostly produced by contract growers.

A major structural weakness of the formal seed sector is the absence of rural outlets. The sector therefore mainly provides seed to public development projects (ADPs), and to a lesser extent to the few medium and large-scale maize producers. The extent of the informal sector, based on community-level seed production and trade, is not known but thought to be substantial. It is actively promoted by the Kano State Agricultural and Rural Development Authority (KNARDA) in collaboration with IITA and GTZ in Northern Nigeria. Two factors seem to drive this local seed trade: (i) the rapid adoption of new cowpea and soybean varieties and increasing area of grain legume cultivation, which is a direct contribution of IITA's crop improvement research; and (ii) the difficulty to store seed safely at the farm level between seasons. Some farmers therefore produce seed off-season in the Fadamas (seasonally flooded lowlands) for commercial purposes. Larger-scale legume seed commerce is limited by infrastructure, transportation costs and policy uncertainty.

The most serious overall brake on seed trade (and diffusion/adoption of improved varieties) is the unavailability of fertilizer. Annual fertilizer use in Nigeria decreased from more than 450,000 tonnes in 1993/94 to 100,000 tonnes in 1999/00 (IFDC, 2000), a shocking 80% decline, as a result of an ineffective liberalization of fertilizer production, blending, distribution and imports (Figure 4.1). The domestic, mainly state controlled production collapsed, and imports and the emerging private sector were perturbed by roller-coaster policies for subsidies, taxes and price regulations.

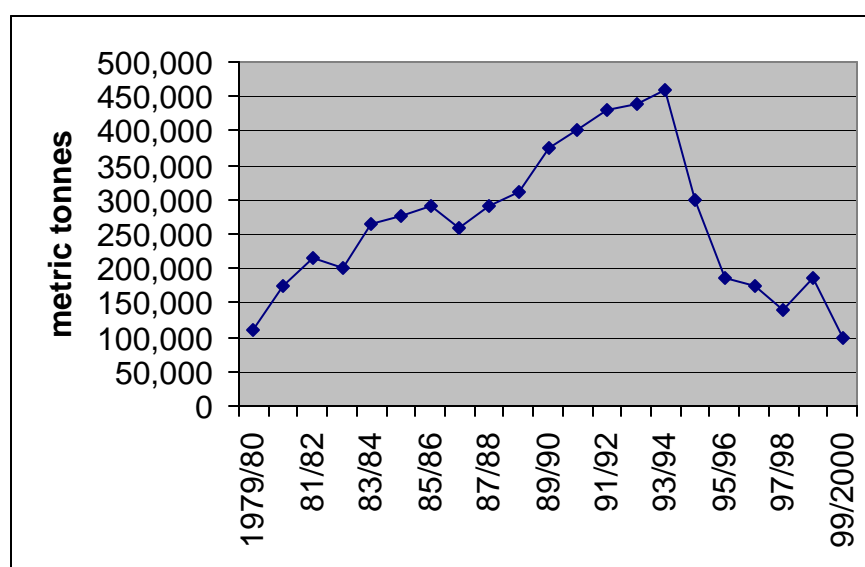
The situation now seems stable, but supply will continue to limit fertilizer use in Nigeria for some time. This, in turn, will limit the demand for seed of improved crop varieties, which is known to be linked to input use, and their yields where they are grown. The pesticide sector has been affected by similar problems, although government interventions seem to have been less heavy-handed. We suspect similar stories in other countries of the region.

IITA is presently conducting a study on the maize seed sector in Nigeria. The Institute also provides breeder's seed to seed companies free of charge, and participates in demonstration trials jointly conducted by seed and fertilizer companies. IITA collaborates actively with the informal seed sector for legumes. No formal market to speak of exists for planting materials of tuber crops. The Panel was not able to consult documents on seed sector studies conducted by other CGIAR Centres in SSA (e.g., ICRISAT), but believes that valuable information exists and should be used in IITA's further regional and national analyses.

The Panel recommends that IITA work more closely with IFDC, IFPRI and other international partners to achieve a better understanding of constraints to the adoption and performance of its improved varieties, with particular consideration given to the agricultural input sector in Nigeria and other countries.

Legislation on seed rights is rapidly evolving in ESA where Kenya, Zimbabwe, Uganda and Tanzania are already members of ARIPO, enabling private companies to own rights to specific genetic materials. IITA so far has granted non-exclusive rights free of charge to users of its varieties, including private companies. One company in Zimbabwe recovers royalties from its clients. In most West and Central African countries, no such policy has as yet been adopted. The Panel commends IITA for taking the initiative to develop an institutional policy for partnerships with the seed sector.

**Figure 4.1 Annual Changes in National Fertilizer Use in Nigeria (IFDC et al, 2000)**



#### 4.5.2 Initiatives with the Private Sector

CGIAR Centres are being encouraged to seek closer relations with appropriate partners from the private sector. IITA has recently taken steps in this direction within Project 13, as a part of the project's 10-year objective to increase returns to land and labour through building commercial tree stock assets in multi-product perennial cropping systems. Cocoa, coffee and cashew are the most important tree-fruit species, although several other fruits, timber and medicinal tree species are also valuable.

Over the years there have been occasional collaborations with the private sector for commercialization of products developed by IITA in the food processing area. Recently, PHMD developed a collaborative project called LUBILOSA for the commercial production of Green Muscle®, a biopesticide for controlling grasshopper and locust outbreaks, by a South African company. Lux Development (a major donor of the Niger Plant Protection Agency) purchased

large quantities of the biopesticide in 2000 for the first commercial applications in Africa. This has been an outstanding example of public domain research being taken up effectively, and IITA received well-merited publicity from this venture.

The Sustainable Tree Crops Programme was launched at a stakeholders' meeting in Ghana in May 2000, as a joint public-private partnership between European and American chocolate manufacturers, bilateral donors, NAROs in Guinea, Côte d'Ivoire, Ghana, Nigeria and Cameroon, several IARCs, and convened by IITA. Cadbury-Schweppes and Mars are two of the major companies involved in the partnership. This initiative is a bold and imaginative step in coupling sustainable income production to environmental reconstruction in the higher rainfall zones of SSA, based on the strong scientific work undertaken in the systemwide ASB programme. The concept of rebuilding multi-storey canopies with an array of commercial tree and non-tree species that can still mimic the original water and nutrient cycling of these systems, has stimulated a wide range of donor participants and collaborators. IITA is to be congratulated on this new initiative.

The Panel believes there are opportunities in commercial collaborations that have not been fully explored in developing the genetic resources of the GRU. Potential certainly exists, with GRU's collections becoming a potential source of valuable genes. In Section 3.2.4.2, the Panel urges IITA to consider taking steps towards making the Centre the favoured partner for genomics investigations of yam and cowpea in particular.

## CHAPTER 5 - GOVERNANCE AND MANAGEMENT

This chapter reviews the functioning of the Board of Trustees (BoT) in carrying out its good governance responsibilities, and the management of the Centre as it relates to the BoT and the support operations of the Institute that complement the research programme. Management of the research programme is addressed in Chapter 2. This section on governance is based on a fuller consultancy report, which was provided to the BoT.

### 5.1 Board of Trustees

#### 5.1.1 Legal and International Status

On July 24, 1967, IITA was officially established in Ibadan, Nigeria by the Ford and Rockefeller Foundations and under Federal Decree 32, subsequently amended by Decrees 27 (1974) and 45 (1990). The Foundations provided the initial funds, while the Federal Government provided the land. Research work started in 1970. In 1971, IITA became one of the original four centres of the CGIAR System. IITA is currently established as an international organization under Nigerian Law. To provide IITA with the same status as most of the other CGIAR Centres, IITA is in the process of seeking status as an international organization under international law. The Centre is governed by a Board of Trustees (BoT) which is authorized by the bye-laws to have a minimum of ten and a maximum of seventeen members; for the past three years, all seventeen positions have been filled. Four Trustees are *ex-officio* members, including three members from the host country and the Director General (DG).

#### 5.1.2 Board Structure and Composition

In 2000, the thirteen members elected at large provided an appropriate representation of gender, north-south and discipline dimensions (Annex VIII). Board meetings are held once a year; and to carry out the work of the Board between meetings, the Executive Committee of the BoT meets an additional two times. Board committees are structured in a traditional manner with Executive, Audit, Nominating and Programme Committees, which meet once a year. The Board Chair serves *ex-officio* on all committees and participates actively in each.

#### 5.1.3 Board Oversight and Policy Formulation

World-wide more emphasis is being placed on boards to perform the function of 'good governance'. While it is difficult to strike exactly the right balance between a board's general oversight function and its engagement in the running of a centre, the Panel feels that the BoT of IITA has not shifted its emphasis sufficiently. This view is compounded by the fact that the 4<sup>th</sup> EPMR made a number of recommendations to 'tighten' the effectiveness of the BoT which were not enacted, in particular those relating to the effectiveness of the Programme Committee. In addition, the functioning of the BoT has been hampered by two factors over the past five years. The first was the decision to hold only one BoT and its attendant committee meetings a year, at

Ibadan. The second was the lack of a written and agreed statement of the respective responsibilities of the BoT and management. In the Panel's view, this combination of factors has constrained the BoT from performing its good governance function adequately.

The Board gives the impression of being willing to carry out its responsibilities and at one level functions at its meeting in an active, engaged manner. A long-standing and harmonious relationship exists between the Board Chair, the DG and the BoT. However, there have been some misunderstandings about the division of responsibility between the Board and the Centre's management. The policies and procedures of the Board and its Committees have not always been consistently documented, sometimes fail to reflect current practice, and occasionally are incompatible with the by-laws. Examples are given in the consultant's report. In addition, there is no regular reporting system in place to keep Board members informed between meetings.

The Panel **suggests** that a number of steps be taken, including:

- the formulation of an agreed set of responsibilities, to include the budget approval process, expenditure authorizations, formal investment strategy, and other related financial matters;
- a brief monthly written report from the DG;
- formulation of job descriptions for top management;
- an approval process for proposed changes to the organizational structure of the Centre.

Like all CGIAR Centres, the legal status of IITA is ambiguous when it comes to a higher court of appeal, especially for international staff. As a result, it is particularly important for the Board to put in adequate policies to resolve appeals beyond the DG. The IITA Board itself is aware of deficiencies in this area.

The BoT is required to provide oversight of a heavily decentralized research and administrative organization. Despite the frequent encouragement of Board members to visit stations in conjunction with other travels or prior to attending the Board meeting, according to Minutes and Board member interviews, few visits were made in the 1996-2000 period under review. In 1996 a Board meeting was held in Cotonou and in 2001 the Executive Committee met in Uganda.

New Board members would benefit from CGIAR-managed orientation courses, improved training and from having a Board mission statement, which spells out the Board's intentions and responsibilities. The Board has adopted a Conflict of Interest policy, which is circulated to prospective Board members for their signature prior to their joining the Board.

#### **5.1.4 Board Performance Monitoring and Assessments**

In order to assure continuous personal and organizational development, the Board is responsible for assessing the performance of the DG, the Board, the Committees and the Board Chair. Assessment discussions, when carried out, are conducted in an informal and conversational manner and as a result the BoT does not get the benefit of everyone's views.

The DG's performance appraisal process needs to be more formal, and the BoT should establish a workplan format, which provides for general objectives, specific objectives/activities, and expected outputs from the DG. Similarly, the BoT, the Chair and Committees would benefit from more frequent and formal assessments of their own performance, which would help identify needed changes and improvements.

### **5.1.5 Board Use of Centre Commissioned External Reviews (CCERs)**

The Board has developed processes for commissioning and evaluating CCERs. During the past four years, six CCERs were commissioned, including one in the area of management, administration and operations. In 1999, the Board developed and adopted Terms of Reference for Board Member Participation in CCERs. Programmatic reviews are usually presented at the next Programme Committee meeting together with a response from the Centre. In the Panel's opinion, reviews could be scheduled in such a way that the chair of the CCER presents the report to the Programme Committee or Board to ensure the CCER Panel's independent viewpoint is fully discussed. The quality of CCERs is discussed in more details in Section 3.1.

### **5.1.6 Board Committees**

The Executive Committee meets three times a year, once in conjunction with the annual Board meeting and as a result the Executive Committee has essentially taken over the Board's role on many matters. The Executive Committee circulates meeting minutes promptly to the rest of BoT, to try to negate the sense developing amongst board members not on the Executive Committee of belonging to a two class structure. The Panel suggests that, when the Executive Committee is meeting in conjunction with the BoT, it addresses only those agenda items, which are explicitly within its charge.

During the period of this review, the Audit Committee has clearly benefited from having persons with business experience available to serve as its chair. The Committee has generally carried out its responsibilities thoroughly and assertively with one or two exceptions, such as more critically monitoring the implementation of the Oracle system and the timely hiring of the head of the internal audit unit. During the review period it is apparent that some policies and procedures within its purview were overlooked and unclear. These include the issue of the rotation of External Auditors, and the annual recommendation to the Board of the appointment of the External Auditor. The Board is required to adopt and adhere to an agreed policy on both.

The Internal Audit function is critical in the environment in which IITA operates. The Panel is very concerned that the Centre has been without a senior internal auditor for the past year and believes that the Audit Committee must take some responsibility for this since good governance requires there is an effective internal audit function. Management is now exploring the option of outsourcing this function. The Audit Committee must be assured that the Internal Auditor is able to communicate directly and freely with the Committee, with minutes of the confidential meeting with the Committee being taken by a committee member. The DG sits in on Audit Committee meetings as an observer. The Panel **suggests** that the Director General not routinely attend meetings of the Audit Committee unless invited by the Committee to discuss a specific agenda item.

The Nominating Committee is comprised of four members plus the DG and the Board Chair, who participate as active observers. Despite appeals from Nominating Committee members, the Board Chair and the DG, the Nominating Committee has generally been unable to receive CVs of new candidates from other Board members, resulting often in a less than comprehensive candidate pool. The Board's "Policies and Procedures" in this area need to be updated and then followed by the Nominating Committee. Greater attention needs to be paid to the succession issue, both at the Board and Committee levels, a process that would be helped by more formal assessment of the performance of individual Committee members and the Committee Chairs. The Nominating Committee's performance has suffered from meeting only once a year but greater use could have been made of other means of communication, such as e-mail, between meetings. As the good governance function gains in importance, it is **imperative** that the Board's composition has a proper balance between individuals with a scientific background and those with a financial/business background.

The Panel is also concerned that there is a clear policy on the duration that one individual performs the role of Board Chair. The Panel **suggests** that if a Chair is re-elected after the initial term of three years, the extension should normally be for one or two years depending on the Chair's tenure on the board, which should not exceed six years in total. It should not, by definition, be an additional three years as envisioned in the new Headquarters Agreement.

The Programme Committee has the responsibility of advising the Board on all matters relating to the Institute's research activities. However, because it only meets once a year, it relies on the Executive Committee for carrying out such important functions as providing timely criticism on the Medium-Term Plan and the Strategic Plan. Furthermore, it is difficult for members to make informed decisions without regular visits to the stations, and attention needs to be given to making this committee more effective in the light of the Panel's comments on the prioritization of research.

### **5.1.7 Director General Search**

One of the most important responsibilities of a BoT is to select the DG. A search process was in place during the review to find a successor to the present DG, who had announced his intention to retire by the end of 2001. The Panel was able to observe the early stages of the search and noted that excellent procedures and timetables were in place.

### **5.1.8 Board Meeting Frequency**

It was decided in 1996 to hold only one Board meeting a year, in Ibadan. This achieved a net saving of US\$91,000 in the first year. Change is accelerating in the CGIAR System; CGIAR set deadlines and Centre activities change more quickly than a single annual Board meeting can hope to respond to and oversee. For an institution with a projected budget of US\$ 35.5 million in 2001, Board expenses that allowed for two full Board meetings a year would be more than justified. This would allow two board meetings a year. Furthermore it is the Panel's view that the single board meeting has become too extended with respect to the fulfilment of its good governance responsibilities. It should be possible to restrict the number of days required for the

second meeting, and possibly shorten the formal part of the present annual meeting. This will make it easier to attract more qualified candidates to accept membership of the board. In addition, serious consideration needs to be given to reducing the size of the board and some of the committees. The proposed new Headquarters Agreement, which is part of the process of establishing IITA as an international organization under international law (para. 5.1.1), provides an opportunity to achieve this reduction. This should include a reduction of the number of *ex officio* positions for the host country as the present number is out of balance.

### **5.1.9 Overall Assessment**

The recommendations and suggestions are intended to improve the Board's oversight and governance role. Insufficient attention has been paid to the recommendations of the 4<sup>th</sup> EPMR, especially as they affected the prioritization of research. The Board process needs to be streamlined and made more effective and responsibilities properly documented and carried out. Improved Board training and the setting of specific expectations must be developed.

**The Panel recommends that the Board carry out a programme of Board reform that includes, in particular:**

- **returning to two meetings a year of the full Board;**
- **reducing the number of members on the Board of Trustees, including the number of host country members;**
- **defining the term of office of the Board Chair;**
- **reducing the time taken at Board meetings for formal execution of its responsibilities;**
- **establishing, documenting, and committing to "best practice" procedures for the Board and its committees;**
- **providing a budget for the Board Chair; and,**
- **commissioning a CCER on Board governance approximately one year after the new DG has taken up his or her appointment.**

### **5.2 Leadership and Culture**

It requires strong and forward looking leadership to manage an Institute with four stations in West Africa, one in East Africa and headquarters in Ibadan, Nigeria, with total staff of more than 1100. Nigeria and Ivory Coast have both seen major upheavals in the past three years and personal safety considerations for the staff must always be uppermost in management's thinking. IITA has been very fortunate having at the helm for the past ten years a mature and experienced DG who has dealt well with these circumstances. The time, energy and patience required to "keep the show on the road" cannot be underestimated. One has only to look at how national institutions and the private sector have fared during the same period to recognize what a substantial achievement it has been to maintain IITA as a unique centre of excellence in West Africa, vital to African agricultural research.

A considerable amount of decision making, fronting for the Institute, and fund raising has evolved to the office of the DG. The Fourth EPMR effectively recommended that a DDG be appointed to line manage research and that international co-operation continues to be line managed by a DDG. However, the DG decided, with the BoT's approval, not to adhere to these recommendations, and as a result the DG has tended to take on a substantial line responsibility for research and international co-operation, including fund raising. The effect is compounded by the fact that the one DDG in the Centre functions as an alternate DG according to the organization chart (see Organization Chart), rather than as a manager with a specific set of responsibilities. An important question the Panel has addressed is whether the management system in place today is so structured that the new DG will be able to function without making major changes.

The present DG has taken on an increasing number of decision-making roles over the past ten years including the leadership of RPEC. This is particularly significant because the DG is away from Ibadan more than half of the time. The Panel senses a weakness in the intellectual leadership of the research programme especially in priority setting, and a lack of clear lines of responsibility and accountability in other areas. This situation has been further exacerbated by the lack of forceful leadership and effectiveness of the BoT, referred to in 5.1, and the fact that the Ibadan campus has a sense of isolation from the real world.

There have been some important staff changes over the past five years, which have included the heads of two of the three research divisions and the head of CSD. At the present time there appears to be a good sense of collegiate spirit, especially at the RPEC level, the senior management committee.

The Review Team has formed the view that it will not be possible for one individual to fulfil so many functions at the same time. If relieved of these day-to-day line responsibilities for research, the new DG will be able to give more attention to a number of pressing issues. The first, in no order of priority, will be to ensure that the overall direction and quality of science at IITA remains world class.

Second, the nature of the relationship between the three IARCs with stations in West and Central Africa, which will be shaped by decisions at the CGIAR level, will require substantial leadership and commitment of time by the new DG if results are to be achieved in a reasonable time frame.

Third, the new DG will need to devote increasingly more effort to fund raising, particularly from new sources of funds. IITA's approach to raising funds from non-traditional sources needs to be re-thought and the organization restructured. The Panel believes a concerted new effort on this front is required, perhaps with the appointment of a part-time development officer based outside the region. This could be co-ordinated with moves to bring the activities of IITA, WARDA, and ICRISAT closer together in West Africa.

Fourth, relationships with the host countries, which are currently very good, need continual attention. The Panel believes the interaction with the Nigerian Government is critical to ensure the continued payment of their important contribution.

Fifth, structured communications both between the BoT and its committees and management need to be improved, to ensure the proper exercise of good governance by Trustees. And finally, the new DG needs to put in place an organizational structure with clear lines of responsibility and accountability to oversee the process of introducing the Oracle-based MIS/FIS system, which is now a year behind schedule.

### **5.3 Organizational Structure**

The Institute successfully reorganized its research activities into multidisciplinary research projects, managed by three research divisions: the Crop Improvement Division (CID), Plant Health Management Division (PHMD), and the Resource and Crop Management Division (RCMD) following recommendations by the fourth EPMR. These are headed by Directors who form part of the line management of the Institute (See Section 2.4). The function of disseminating research results to national systems rests with Project Co-ordinators and liaison with NARS is monitored by the External Liaison Office, that reports directly to the DDG and DG. The information and training function is in a separate office with similar reporting lines.

The fourth division, CSD, encompasses the functions of administrative services, budget and finance, computer services, hotel and catering, personnel and medical, the physical plant services at Ibadan, and security, with its director on RPEC and reporting to the DDG/DG.

As IITA now has 44% of its IRS and several of its project leaders based outside Ibadan, the co-ordination of activities, finance, and control of such a decentralized organization is challenging in the African context, especially in a tight budgetary environment.

### **5.4 Human Resources**

Between 1996 and 2000, total staff at IITA declined 37% from 1752 to 1101 (Annex IX), with staff at Ibadan declining by 20% and at stations by 45%. IITA classifies staff as Internationally Recruited Staff (IRS), paid in US\$, and Nationally Recruited Staff (NRS). Regular IRS declined by 21%, primarily at Ibadan, but was offset in part by the increased employment of postdoctoral fellows, associates and visiting experts. During the same time period, NRS declined by 40% from 1638 to 995, the biggest decline being at stations where the number of NRS dropped by 50%. In 2001, further staff reductions were made throughout the Centre. Today, a station would have about the same number of scientists as in 1996; these would include fewer IRS but more postdoctoral fellows and visiting scientists, about half the number of NRS, and hosting more scientists from other CGIAR centres. The Panel conducted a survey of all IRS and NRS Research Associate level, attaining a 60% response rate. Specific results are incorporated throughout the Panel's report.

Human Resources at IITA is not a distinct programme headed by a Human Resources manager; the functions for IRS and NRS are performed by separate units each reporting to the Director, Corporate Services. In January 2001, human resource matters pertaining to IRS were

integrated into a single IRS position. All IRS are recruited and contracts issued from Ibadan. A nationally recruited staff member has direct responsibility for NRS in Nigeria and for setting policy institution-wide; recruitment and implementation of policies for NRS outside of Nigeria are handled by each station administrator. The Panel believes there are advantages to the Human Resources function being further integrated into a single unit under one manager.

As costs have needed to be contained and reduced, the Centre has responded by outsourcing security, reducing positions and being less aggressive in filling certain vacancies in both IRS and NRS positions. This latter response has been particularly unfortunate in the case of the head of internal audit, essentially vacant for more than a year. This is addressed further in section 5.5.6.

In 2000, Internationally Recruited Staff represented 35 nationalities with 43% coming from African countries, 34% from Europe, 14% from North America and 10% from Asia. During the period under review, the number of African IRS increased by 50%, offset by equal decreases in North Americans and Asians. During this same period, female IRS dropped from 19% of the total IRS to 14%, while the number of African female IRS doubled. The percentage of women IRS at Headquarters versus being outposted has remained essentially constant comparing 1996 with 2000. Concern about the lack of a critical mass of outposted female IRS (4% of all IRS) was raised in the staff survey conducted by the EPMR.

The IRS Personnel Policy Manual was updated in 2000 when some of the detail in the manual was removed to a Manual of Policies and Procedures and an internal grievance process was added. Information on performance appraisal procedures, position classification categories, and associated salary ranges would be better included in the Personnel Policy Manual for ease of access and transparency, two issues mentioned by IRS surveyed and by the previous EPMR. The Manual would also benefit from the inclusion of a sexual harassment policy and an extension of the grievance policy to cover situations where an appeal may need to be taken to the Board level. Open and transparent recruitment policies and procedures for IRS are spelled out clearly but there is a perception among some scientists that these have not been followed in a number of situations in the past two years. This has led to some morale difficulties.

Performance appraisal procedures for IRS are spelled out but not uniformly understood by or communicated to all affected. The appraisal process and ratings need to take into account the diversity of competing IRS responsibilities. While the Centre is under pressure to contain salary costs, an explanation of the reward system used in the past two years could make the modest increases more palatable. The approach used and the rationale underlying the salary increases have not been well communicated, according to some staff surveyed. Information on the percentage of scientists receiving each rating would also make the process more open.

Internal staff development for IRS is being given more attention despite budgetary constraints and has been identified as a priority area. There are however, opportunities for more systematic and structured seminars, particularly at stations. An International Staff Association has been inactive for the past several years, partly due to a perception that management was not receptive to views critical of management action. Overall, personnel management of IRS is rated as satisfactory.

Changing economic conditions in many of the countries in which IITA Nationally Recruited Staff (NRS) are located have created extremely difficult financial and social pressures on IITA. Recent labour unrest in Nigeria generally was mirrored by a strike of NRS at Ibadan. Labour unions in Nigeria have become more successful in negotiating and, as a result, have raised expectations in non-union environments as well. Labour problems at IITA Ibadan stimulated similar problems and a confrontational strike at IITA Cotonou. Benin devalued its currency with a resultant impact on staff and pressure on IITA salaries there. As IITA experienced its own increase in costs as a result of inflation, it abandoned its long-time remuneration policy of keeping NRS salaries in the upper quartile of comparator manufacturing organizations. The Institute is faced with balancing the legitimate competing needs of the NRS and the constraints of its own financial situation. Yet NRS salaries have increased disproportionately, compared with other costs, over the past several years. If the Centre leans too heavily in favour of financial constraint it risks losing valued employees. NRS want to be assured of a fair package that reflects their years of service without a pension and the productivity demands that IITA places on national staff, and to have some external, quantifiable measure of the competition as provided by comparator employers to assure equity. Management, understandably, wants greater flexibility. These are dilemmas to be managed rather than problems to be solved.

Salary classifications for research NRS have a ceiling of Grade 10, while on the administration side positions are classified up to Grade 15. It would seem there would be benefit in developing NRS researchers, some of whom have masters degrees or PhDs (even though this is not a position requirement) by encouraging greater job responsibility and greater flexibility in grades. Some CGIAR Centres have dealt with this issue by creating a Regionally Recruited Staff (RRS) classification to help bridge the large step in competencies required of NRS compared to IRS. There is a need for CGIAR Centres to collaborate on personnel policies when staffs from more than one Centre are working on the same station. This requires agreement between Centres on performance expectations for NRS, particularly for scientists and forward-looking policies that encourage staff development.

The Panel supports the recommendation of the previous EPMR on combining the human resource function.

**The Panel recommends that a single manager oversees the human resource function, reporting to the Director of the CSD, and secondly, that there is a greater degree of flexibility in its NRS scientist policies to ensure consistency between the administrative and research staff and among the CGIAR Centres operating at one station.**

## **5.5 Finance**

### **5.5.1 Overall Position**

The fourth EPMR found that IITA enjoyed a relatively sound financial position with a high degree of liquidity, by following a very conservative budget strategy. However, by the time

of the CCER on Management, Administration and Operations in May 1998, the overall financial position was beginning to cause concern. The CCER recommended that because of the uncertainties surrounding donor support and the time it takes for cost-cutting exercises to have their impact there should be a balanced budget in 1999. The CCER formed the view that from 1995-1998 IITA had operated with considerable budget constraint, reducing manpower and costs in line with revenues. The Review believed that some further "across the board" savings could be made but doubted that the required cuts of approximately US\$ 1.6 million could be achieved in this way without putting at risk the minimum critical mass of IRS required to carry out IITA's mandate. It therefore recommended that studies be made of the effect of cutting either entire research projects or stations, and that these be discussed with potential donors before undertaking the cuts. But a balanced budget for 1999 was seen as critical. In the event IITA adopted budgets with a deficit target of US\$ 855,000 for 1999, US\$ 1,500,000 for 2000, and US\$ 1,282,000 for 2001.

The actual deficit for 1999 was only US\$ 191,000, principally due to an increase in unrestricted core contributions from the Government of the Netherlands and the Federal Government of Nigeria, the latter's contribution increasing from a budgeted US\$ 100,000 to US\$ 1,050,000. The approved deficit for 2000 was reduced to US\$ 801,000 mid year on the basis of an expected increase in the contribution from Nigeria. In the event Nigeria's contribution increased from a targeted US\$ 500,000 to US\$ 997,091 and an additional increase from the Government of the Netherlands of US\$ 293,000, together with cuts in operating costs of US\$ 1,049,000, resulted in a surplus of US\$ 171,000.

The Executive Committee required a balanced budget for 2001 and requested cuts in the operational budget of US\$ 1.3 million to balance the budget proposed by management. With new grants expected from the EU of US\$ 844,000 a surplus of US\$ 122,000 is now forecast.

Unrestricted funding, as a proportion of the total operating budget has been relatively stable: 49% in 1997, 50% in 1998, and 48% in 1999 and 2000. If the operational budget increases by the projected 20% in 2001 and 2002, unrestricted funding, as a proportion of the total operating budget would fall to the 40% level. This would reduce management's flexibility to manage the budget in a particularly fluid environment, when local staff salaries are heavily influenced by unexpected changes of government policy and host country inflation is endemic. However, the overall expenditure budget has been falling as management cut costs, from US\$ 34.0 million in 1996 to US\$ 29.7 million in 2000. At the present time, the BoT has approved budgets for 2001 and 2002 that indicate greater expenditure levels of US\$ 35.5 million in 2001 and US\$ 35.2 million in 2002, as shown in Annex IX.

### **5.5.2 Operating Reserves**

In 1996, measures were introduced to limit capital expenditures to a maximum of that charged for depreciation. In practice, capital expenditure has been less than the depreciation charge and the capital fund increased from US\$ 4.350 million at the end of 1998 to US\$ 5.168 million by the end of 1999. By end November 2000 it had increased to US\$ 6.343 million. The Operating Fund totalled US\$ 6.177 million at the end of 2000 and is expected to be US\$ 6.299

million by the end of 2001. The Institute's operating fund level of about 76 days is below the CGIAR guideline of holding at least 90 days of operating funds.

The CGIAR Accounting Policies and Reporting Practices Manual of March 1999 proposed changes in the way the "set aside" of funds for asset replacement is managed. The merging of both Operating Funds and Capital Funds into one "Unrestricted Net Assets" account was proposed. Thus the mandatory build up of the Capital Fund to replace pre-1991 assets is no longer required. This has resulted in significantly lower depreciation charges.

Present estimates of capital expenditure required over a five-year period to remedy the situation on the Ibadan campus and at the stations are in the region of US\$ 6.5 million, of which US\$ 5.0 million would be at Ibadan. Under the proposal to the May 2001 BoT meeting, this would result in the capital fund being reduced to US\$ 3.4 million by the end of 2005. The Panel suggests that IITA investigate whether part of these costs, and in particular the Naira costs of the Ibadan related expenditure, could be supported by the Federal Government of Nigeria.

### **5.5.3 Investment Income**

IITA has continued its non-speculative, conservative investment policy. Funds are invested in Triple A rated bank time deposits, which currently yield about 6% per annum. Total investment income was US\$ 904,000 in 2000, which was US\$ 400,000 higher than originally budgeted. A similar level is expected in 2001, but with falling interest rates this may be over-optimistic.

In the future, US\$ 2 - 3 million of the Institute's assets will be pooled for investment purposes by the CGIAR together with funds from other institutes. The 2001 BoT is set to approve the investment policy at the May Board Meeting.

Opportunities for other income-generating activities appear limited. Charges are made for food and lodging at International House at below off-campus rates, which generates just over US\$ 1 million a year. There is a delicate balance between serving the needs and wishes of the resident community and attracting outside visitors and the present figure is probably at the upper end of what is feasible. A charge is also made for external students at the primary school on the campus which generates a further US\$ 200,000.

### **5.5.4 Currency Management**

The CCER in 1998 concluded that Budget and Finance staff had used the Nigerian Debt Conversion Programme to good effect since its initiation in 1989. An average of US\$ 500,000 has been 'saved' as a result of participating in 1998 and 1999. However, staff reports that with the improvement in the investment climate since the change of Government, major players, such as Citibank, have entered the programme and IITA is finding it increasingly difficult to obtain funds through this scheme.

The CCER also recommended that currency hedging, which IITA initiated in 1996, be discontinued: "Unless IITA believes that it can outguess the currency markets over the long term

there will be a net cost to these hedging contracts". IITA was purchasing certain foreign exchanges in the forward market to 'fix' the cost of operating in francophone countries and to protect the expected erosion of the value of certain currencies against the dollar. Despite this recommendation the practice was continued with Board approval and in 2000 losses of US\$ 400,000 were recorded compared to a recorded gain from the activity in 1999 of US\$ 300,000. The programme is no longer in use.

### **5.5.5 Overhead Ratio**

The CGIAR Secretariat carried out an indirect cost study for all centres in early 2000 to ascertain the apparent efficiency and to determine whether a single overhead rate was applicable for all the centres.

IITA's overhead rate ranks fifth highest after WARDA and four other centres. The ratio of indirect cost to direct cost was 22.76%, which is not significantly higher than other large developing county-based campus institutes (ICRISAT 22.4%; IRRI 21.3%).

IITA recovered US\$ 1.6 million in 2000 through charging overheads in project funding proposals. This is approximately 7% of the total restricted grants received, a ratio that has been constant for the past four years. A crude approximation would suggest that if all proposals for restricted funding had carried an overhead charge of 22.76%, the total amount to recover would be about US\$ 3.2 million. The estimates of restricted funding for 2001 and 2002 are higher and the hypothetical amount to be recovered will increase to some US\$ 4.4 million. An amount of US\$ 1.6 million has been included in the budget for each year, which, according to management, represents an overhead charge of about 13% only. The decision not to include the overhead charge in a special project proposal has to be authorized by the DG.

The Panel believes that management should adopt and follow an explicit policy with regards to including a standard overhead charge in all projects to be funded by restricted funds and that this is agreed by the Executive Committee.

### **5.5.6 Internal Audit**

There appear to be no major issues on the financial front. However, despite strong recommendations from the Audit Committee in May 2000, the BoT management has not been able to recruit a suitable IRS to manage this unit, which has also lost one of its two NRS staff members. There are issues that need tackling relating to the identification of wastage, and the work of the unit needs to take account of the 4<sup>th</sup> EMPR recommendation to shift more to operational audits.

At the request of the DG, the External Auditor has submitted a proposal to provide this service on a consultancy basis, which, if accepted, must operate separately to the external audit function. This arrangement may improve the impartiality of the unit, and reduce the overall costs of the internal audit.

The Panel **suggests** that arrangements be entered into to ensure an effective internal audit function post haste.

### **5.5.7 Management Information System (MIS)/Financial Information System (FIS)**

Since 1997, management has been planning to introduce a sophisticated computer based MIS and FIS system to improve the efficiency of IITA's operations. In early 1999, an Oracle system was chosen, a budget agreed and an organization delineated. It took considerable time to appoint an individual to run the unit responsible and he left early in 2001 after a year in the job. A new head with apparently better experience took over in February. Despite assurances given by management to the Audit Committee in 2000 that the implementation system was on schedule and would be operational by the beginning of 2001, it is clear that it will take another year at best, and only if senior management provide the sponsorship, guidance, oversight, and allocated budget that have been sadly lacking to date.

The Panel was informed that outside international consulting services had recently been engaged to advise on and assist with system installation and were proving very effective. Data preparation for inventory, purchasing, and accounting has been completed and system installation has just begun. The plan will complete testing by the end of September; it will then begin running on a trial basis, and run the system parallel to the existing system from the beginning of accounts for 2002.

Experience elsewhere and in the CGIAR suggest that unless properly staffed, organized, planned, and managed from the start, introducing changes of this kind to an institution can end up over budget and delayed, and cause serious frustration to staff.

IITA should put in place an appropriate management team for the Oracle-based MIS/FIS, accountability should be delineated, and a realistic budget approved as soon as possible.

### **5.5.8 Fund Raising**

At the present time, fund raising at IITA is spearheaded by the DG but is, in effect, somewhat *ad hoc* as there is no formal fund-raising strategy. Each scientist is "on their own" with guidance from the external liaison office, which is the line unit responsible for overall fund raising and which has a small operating budget of about US\$ 100,000 per annum. Its head concentrates on initiatives in Africa. The DG has an effective calling programme on the present major donors. The Financial Requirements of the 2001 CGIAR Research Agenda estimates that about 1-2% of grant support received by centres comes from public and private sectors organizations that are not CGIAR members. What appears to be lacking is a cohesive focused plan of action to target and court new sources of funding, particularly the non-governmental foundations and trusts, such as the Gatsby Foundation, which has funded IITA for many years. An institution of this size requires a greater expenditure on fund raising to ensure adequate funding.

Consideration should be given to engaging a full time or part time professional development officer overseas. This is a function that could be shared amongst a number of

institutions, with Africa as a common theme in their mandate. This is particularly important, if as projected, the proportion of unrestricted core funds in the overall funding declines.

Summarizing the main points of the preceding sections, 5.5.5 to 5.5.8:

**The Panel recommends that the following steps be taken with regard to financial management:**

- **putting in place an effective internal audit function;**
- **a comprehensive framework for the installation of the Oracle-based MIS/FIS be put in place;**
- **consideration be given to engaging an overseas development officer; and,**
- **adoption and rigorous implementation of an overhead charge policy.**

### **5.5.9 External Liaison Office**

The fourth EPMR recommended that the International Co-operation Unit continue to be led by a DDG and undertake a review of its priorities, strategies and activities, in order to respond effectively to the emerging opportunities for improved partnership with NARS and other collaborators. It was subsequently felt that it was the interaction at the project level by individual scientists that was highly valued by NARS. As a result, the relevant research projects and project co-ordinators were made directly responsible for the regional activities related to them and the International Co-operation Division was dissolved. Co-ordination and support is left to the individual scientist.

The fourth EPMR called for a more "vigorous move by IITA to establish correspondingly effective working relations with NARS". Decisions made since then on the organizational structure do not reflect this objective. Furthermore, it should be recalled that one of the key rationales behind the move to working on an AEZ basis was to try and involve the NARS and NGOs in the planning and execution of regional programmes. The Panel sees the need for central co-ordination of this activity, which will involve the AEZ team leaders.

**The Panel therefore recommends that the status and importance of the position of the Head of the External Liaison Unit be upgraded, but not to DDG level.**

In addition to these responsibilities, the principal line responsibility for fund raising also rests in this office.

## **5.6 Physical Plant and Infrastructure**

### **5.6.1 The Physical Plant Services (PPS) Unit**

The Physical Plant Services (PPS) Unit at Ibadan is the largest at IITA with approximately 280 staff members. The unit is responsible for the maintenance and operating

condition of all of IITA's Ibadan campus grounds, buildings and equipment. PPS is responsible for maintaining and operating all the essential Ibadan campus services such as power generation and distribution, chilled water production, communications, and water treatment. Onne and Kano stations rely directly on Ibadan for most services and PPS and CSD provide technical assistance to the three stations outside Nigeria, as required. In the circumstances the unit has done a most credible job in keeping IITA Ibadan running effectively during the difficult past five years in Nigeria.

PPS has over time reduced its staff strength, and the number of IRS has been reduced from seven in 1984 to three today at the same time as its services have expanded. The present annual operating budget for the division is approximately US\$ 2.4 million.

Most of the buildings and services on the Ibadan campus are now almost 30 years old and need major capital expended to replace ageing equipment and for refurbishment. One of the old water chillers was replaced in January 2000, which has brought some relief to the system. The old Power House was replaced in 1997, and the sewage treatment plant is reported to operate in an extremely overloaded capacity. A new Power House was designed and commissioned entirely by PPS staff in 1997, with an estimated saving of approximately US\$ 750,000 if a third party had been involved. PPS plans to add another sewage treatment plant designed and fabricated in house, in the near future.

A number of further improvements have been made recently. A 33KV overhead line from the Nigerian Electrical power Authority (NEPA) was commissioned in July 2000 as the supply of electricity from NEPA had deteriorated to such an extent that IITA was generating over 75% of its own power requirement, with the result that about US\$ 500,000 was being expended on diesel fuel. And the old analogue telephone exchange, commissioned in 1985, was replaced in December 2000 by a modern digital exchange. The new exchange, Harris 20-20 IntelliCom, is a fully integrated, non-blocking digital switching system capable of supporting the most demanding networking and stand alone private voice/data switching system requirements.

The vehicle situation has been a constant source of concern for many years. The Institute maintains more than 15 different models and the lack of standardization has necessitated the carrying of large inventories of spare parts, at considerable cost. The Toyota models in the fleet are targetted by armed robbers and there have been a number of instances where staff safety has been at risk. There is a need for standardization.

The existing radio link network makes communications manageable between Ibadan and its offices in Nigeria, namely Kano, Abuja, Onne, Umudike and Lagos. The network is also used by the IITA aircraft, which is an essential link in the communications system of the Institute. Satellite communications are being installed between Ibadan, Cotonou and Yaoundé, and should be operative by June, which will allow considerably more efficient communication using the Intranet.

There have been more and more break-ins and hold-ups on the campus over the past three years, which is more a reflection of the general situation in the country than of IITA's management of the problem. Indeed the decision to contract out the security function to a

private security company at the end of 1999, in order to save on costs, seems to have been a good decision. It is estimated that savings were in the order of 40% or US\$ 200,000 in 2000.

Further opportunities to contract out services are being investigated including custodian services, travel services, contract labour and the maintenance of the grounds, though there is some apprehension in the latter case that contractors with adequate machinery will be difficult to locate in Ibadan.

### **5.6.2 Material Logistics and Shipping**

This department comprises three integrated units: purchasing, shipping, and stores. Purchasing has been reorganized so all orders are processed by one and not, as previously, two agents. The unit processed approximately 3,000 purchase requests last year and raised 2,500 local and overseas purchase orders. The PPS store has been enlarged, re-designed and re-organized, and a set of policies enacted that cover all aspects of purchasing and inventory control. The main problem at present is the lack of an on-line computer system for the control and co-ordination of purchasing, inventory control and shipping. The introduction of the Oracle system should rectify this situation.

### **5.6.3 Other Corporate Services**

The Centre in Ibadan provides high quality pre-school/primary education for the children of IRS staff, is open to NRS children who live on campus, and to children from Ibadan who comprise half the students. A clinic provides basic medical services to IRS and NRS and their families but falls short of IRS expectations. As services continue to deteriorate in Ibadan, X-ray facilities and dental services are needed and IRS have concerns about the quality of diagnoses of some fundamental illnesses, e.g., malaria. Although the clinic was asked to submit a 5-year capital plan, no funds for its improvement have been included in the budget submitted to the Board. A Community Resource Centre has been created to provide a forum for spouse activities and is being actively supported by the Institute.

### **5.6.4 Stations**

Conditions vary considerably at the stations. As IITA continues decentralization, any station that is not hooked into the overall IITA system is isolated both scientifically and administratively. At Kano, a satellite dish is urgently needed (but not included in the 2001 budget) for improved communications and access to library/information services. Library resources are essentially non-existent. Laboratory facilities, including the uninterrupted supply of electricity, need upgrading and more adequate computer facilities are lacking. Uganda presently has difficult email connections at the research site at Namoulonge, where some IRS also live, and which is some distance from the ESARC offices. As difficult as it may be, the Panel **suggests** that urgent attention be given to creating a minimal standard for communication capabilities and power generation at all stations.

### **5.6.5 Integration of IITA,WARDA and ICRISAT Support Services**

Work has started in analyzing the cost efficiency of merging the support services in West Africa of the three CGIAR centres. This could encompass research support including the outsourcing of translation services, infrastructure and PPS including the provision of instrumentation maintenance services, financial services including external and internal audit functions, computer based financial and managerial information systems, and collaboration on training of NARS trainers. Corporate services of IITA will need to be rethought depending on progress.

## **5.7 Overall Assessment**

The next year will be a period of substantial transition at IITA, and possibly within the CGIAR system, which will also affect IITA. The Panel has therefore recommended that a number of steps be taken with immediate effect by present management to help create a sound basis for this transition. At the Board level, this would include steps to make the board a more effective and accountable body, including a streamlining of its committees to make them more manageable; twice yearly meetings; written delineation of responsibilities between management and the board incorporating accountability; a definitive policy on the Chair's length of tenure; and structured and timely communication between management and the Board (refer to 5.1).

Human resource management is a particularly sensitive issue in the environment in which IITA operates and the Panel has recommended that the management of this function be integrated into one command structure, and that policies with respect to NRS researchers be reviewed (refer to 5.4).

Other Panel recommendations relate principally to the overall financial position and management of IITA, and include the desirability of appointing a development officer with responsibility for fund raising from sources outside the CGIAR; enacting a formal overhead charge policy; raising the importance of the international co-operation function; pursuing the integration of some of the research support systems with WARDA, and possibly ICRISAT; establishing a fully functioning internal audit group; and instituting effective sponsorship for the introduction of the Oracle based MIS/FIS system.

## CHAPTER 6 - CONCLUSIONS AND FUTURE VISION

### 6.1 IITA Today

A quantum leap in agricultural productivity 30-40 years ago propelled economic development in much of Asia and South America. Scientific innovations delivered by IRRI and CIMMYT, shared with NARS partners and adopted by farmers, provided the technological basis for this evolution. In SSA during the same time span, economic development has faltered precisely because the transformation of agricultural development has been slow to take off. Political upheaval and inappropriate policies have hindered progress towards the alleviation of poverty and achieving food security and natural resources conservation in SSA. These conditions create a challenging operating environment for IITA and its NARS partners in SSA.

Despite these setbacks, there remains a critical mass of well-trained African scientists in the NARS. Many of these scientists have been trained at IITA, and if given adequate support, could lead the transformation of African agriculture. In a difficult operating environment, IITA continues to demonstrate that it is possible to conduct high quality science and move innovative technologies to the NARS for adoption by farmers. In many ways, the Centre represents the core of the agricultural science community in WCA. If IITA falters, much of the cumulative investment in building scientific capacity in the NARS will have been squandered.

After a thorough review of IITA's programmes and management, the EPMR Panel concludes that the Institute's research programmes are making significant contributions to improving the quality of life in SSA. IITA scientists have maintained a world-class core competency in biological control, regional leadership in germplasm improvement and conservation for the major food crops in West and Central Africa, and are exploring new participatory approaches in research on resource and crop management. Evidence in support of this conclusion comes from our evaluation of research outputs in the form of refereed publications, books, and impact assessments; our meetings with IITA scientists and staff; and our site visits and discussions with NARS representatives from five countries in the region.

IITA and its partners have achieved remarkable success in producing research outputs that are having positive impact at the farm level. Among the most notable achievements are: (i) new biological control methods for a number of important crop pests; (ii) varietal releases to the NARS of mandate crops with higher yields and greater yield stability than varieties in current use; (iii) the integration of new IITA crop varieties, soil fertility and integrated pest management options into cropping systems that achieve increased food production and profit in a sustainable manner. In addition, the Institute has adopted an agroecological framework for the identification and implementation of its research agenda in the four agroecological zones (AEZs) of its mandate region. The Panel supports the AEZ approach and believes it can provide an effective framework for identifying, prioritising, and co-ordinating the research agenda in collaboration with NARS partners and other IARCs.

Closer working relationships with NARS partners are evident from concerted efforts of the past five years. IITA now works closely with the SROs in developing its broad strategic plans and actively engages stakeholders representing NAROs, NGOs, farmer groups, and the private sector in planning its specific research agenda at stations located within the major AEZs. Networks also have been used effectively to strengthen the research capacity of NARS partners and to facilitate the transfer of technologies and germplasm produced by its research programmes.

The Panel identified a number of areas that need strengthening, both in research and management. Increased capacity in the social sciences, efficient use of biotechnology tools to support crop improvement, and greater strength in geo-spatial analysis and dynamic modelling are needed in research. Clear priorities and a more structured process for setting the research agenda are needed to guide strategic plans. Stronger day-to-day management and leadership of research programmes are needed to ensure accountability for implementing the research agenda and monitoring its quality. The Panel also believes that the conceptual models underpinning the implementation of the benchmark area approach within the AEZ framework in a decentralized research mode need clearer definition.

Notwithstanding these concerns, which we believe can be adequately addressed, **the Panel concludes the EPMPR with a firm conviction that the need to maintain IITA as the premier international agricultural research institution in WCA is more important than ever.**

## 6.2 IITA Tomorrow

Two significant changes are anticipated during the next five years that will provide challenges and opportunities to IITA and its partners. The first is a likely scenario of continuing political instability and difficult operating conditions for the conduct of research and technology transfer in the mandate region. These conditions will hamper efforts to build NARS capacity in research and technology transfer, maintain IITA's research facilities and recruit scientific talent. Strategic planning efforts must address these challenges, and the Panel sees opportunities for a wider range of partnerships and a distributed regional research approach.

For example, the Panel suggests greater efforts to forge formal working relationships with international financial institutions and the development projects they fund to strengthen NARS capacity. A careful balance is needed between research investments at IITA's Ibadan Headquarters and those at the research stations in benchmark areas. Use of short-term consultants could be expanded to accomplish specific research objectives. More formal collaborative linkages can be established with eminent scientists in key disciplines at universities and other research institutions worldwide to enhance research capacity in specific areas. Short-term sabbatical leave for IITA scientists to work with these experts are another possibility. These and other innovative approaches will be needed to ensure that research goals and objectives can be accomplished in a difficult operating environment.

The second major factor is the greater emphasis on a regional research approach within the CGIAR and among projects funded by donors and international financial institutions. The Panel sees exciting opportunities for IITA as a partner in regional research, both with the SROs and with other IARCs that operate in WCA. In particular, we note the strong endorsement given by CORAF/WECARD to the initiatives to date on co-ordinating activities and merging support services amongst IITA, WARDA, and ICRISAT. The Panel believes that these Centres should move on a faster track towards integrating operations, planning, and programmes. The AEZ framework provides a useful mechanism to facilitate this planning because it also is used by many of the NAROs in the region to categorize agroecological zones and to organize research programmes.

The Panel sees a number of core competencies in which IITA can play a leadership role at global and regional levels. The Institute is well positioned to be a global leader in research on biological control of pests and integrated pest management. It is a regional centre of excellence in crop improvement and germplasm conservation for staple food crops such as cassava, yam, plantain/banana, soybean and maize in WCA, and a global leader in cowpea improvement. It should aspire to become the world authority on the intensification of farming systems in SSA and the processes by which these systems contribute to poverty reduction, food security, and natural resource conservation.

There is a new generation of young African farmers who are much better educated than their parents because of continuing investments in education. These young men and women will drive agricultural development for decades to come. To fully leverage this vast pool of human resources, IITA must maintain itself as a centre of excellence to ensure that breakthroughs in science and technology will continue to be available to the next generation of African farmers.

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The Panel was fortunate in being able to visit most of the IITA stations, in Nigeria, Benin, Cameroon, and Uganda, and wishes to express its gratitude for all the logistical support, information and wonderful hospitality provided by IITA's staff. Also, thanks are due to the many IITA collaborators in the respective government agencies, universities and NAROs, and in particular to the many farmers we met along the way. Special appreciation goes to Drs. B.B. Singh, Stephan Weise, Peter Neuschwander, and Jim Whyte, team leaders in Kano, Yaounde, Cotonou, and Kampala, for their help in successfully organising and hosting Panel visits to those IITA stations. Unfortunately there was no opportunity to meet the team at Onne.

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The Panel was indeed fortunate to have Irmi Braun-Castaldi of the TAC Secretariat with them during the Main Phase of the review, bringing order to the sometimes hectic and hurried pace of the Panel. In addition to the many word-processing tasks, Irmi coordinated the preparation of the report, when she was not busy reconfirming and rescheduling Panel members travel arrangements. She was most ably assisted by John Babalola, IITA Secretary in RCMD. Both Irmi and John worked extremely hard and put in many long hours to help the Panel complete its report, for which the Panel is sincerely grateful.

It is the Panel's pleasure to also thank the TAC Secretariat (represented by Tim Kelley who accompanied the Panel throughout) and the CGIAR Secretariat (represented by Selçuk Özgediz who joined the review team for eight days during the Main Phase) for coordinating this review and for providing guidance. It was a pleasure to work with them on this review.

