



SCIENCE COUNCIL

CGIAR

**Report of the
Fifth External Program
and Management
Review (EPMR) of the
Africa Rice Center
(WARDA)**

January 2008



SCIENCE COUNCIL

CGIAR

Report of the
Fifth External Program and
Management Review (EPMR) of
the Africa Rice Center
(WARDA)

Review Panel: Eric Tollens (Chair)
Zelia Menete
Pammi Sachdeva
Brigitte Courtois
Mary Ncube (Consultant)
Toshihiro Hasegawa
(Consultant)

JANUARY 2008

The Science Council of the CGIAR encourages fair use of this material provided proper citation is made.

Correct citation: CGIAR Science Council (2008) Report of the 5th External Program and Management Review of the Africa Rice Center (WARDA). Rome, Italy: Science Council Secretariat

THIS DOCUMENT CONTAINS:

- Extracts from the Summary Record of Proceedings of the Annual General Meeting 2007 (AGM07)
- Science Council Commentary
- Transmittal letter and WARDA Response to the Fifth EPMR
- Transmittal letter and Report of the Panel on the Fifth WARDA EPMR



Consultative Group on International Agricultural Research (CGIAR)

CGIAR Annual General Meeting, 2007 (AGM07)¹

Agenda Item 6. Evaluation

...

6.b WARDA EPMR

Conclusion and Decisions:

- The CGIAR endorsed the ExCo recommendations on the 5th WARDA EPMR and commended the Center for a positive review and its ability to maintain standards and results during a time of turmoil.
- The CGIAR cautioned against too rapid expansion of the Center by taking a deliberate approach that builds on core competencies.
- The likely support of Egypt to WARDA was welcomed by the CGIAR.
- The CGIAR requested WARDA to keep the CGIAR Secretariat informed on negotiations with IFPRI on transfer of the HIV-AIDS initiative to ensure a systemic view on such issues.

¹ Extract from the Summary record of Proceedings of Annual General Meeting, 6-7 December 2007

**Science Council Commentary on the
Fifth External Program and Management Review (EPMR)
of the Africa Rice Center (WARDA)**

September 2007

The Report of the 5th EPMR of WARDA was discussed at the Eighth Meeting of the Science Council (SC), at Bioversity International's HQ in Maccaresse, Italy. On behalf of the Review Panel, Eric Tollens, Chair, presented the main findings and recommendations of the Report. Gaston Grenier, WARDA Board Chair, and Papa Seck, WARDA Director General, responded on behalf of the Center. The SC considers the report to be well written, and reflecting a frank and analytical review of the relevance and quality of WARDA's research, as well the Center's management and governance. The report addresses the ToR for the study, and is thorough in its analysis, often using cited references that lead to the many well-considered recommendations and suggestions. The SC especially commends the Panel for its excellent analysis of WARDA's work on genetic improvement, and for the report's section on quality assurance. The SC further notes that, given that WARDA is a relatively small Center with a one-crop mandate, the Panel was able to do an in-depth analysis of program content, and that the Center stands to benefit a great deal from this. The SC is also pleased to know that the Center management considers that the review was carried out in a participatory and transparent manner. The SC notes, however, that the report was rather long (137 pages plus 68 pages of Annexes).

The SC appreciates the report's analysis of the 'Ivorian crisis', and joins the Panel in its praise of the way in which the Center has been able to weather the crisis, in spite of the series of forced relocations between 2002 and 2004 of the Center's headquarters, first from Côte d'Ivoire to Mali (and Abidjan), and finally to the IITA-Cotonou station in Benin in 2005. The SC is pleased to note the Panel's conclusion that WARDA "has continued to do reasonably good research, maintained functioning corporate services, and is now poised to launch a period of phased growth", consolidation and stability, guided by an effective Board of Trustees, and ably led by its senior managers. The SC is in agreement with the Panel's report, its 18 recommendations, and several suggestions, and believes that they will help WARDA move forward in the right direction. Key issues addressed by the EPMR are discussed below.

Strategy and Research Planning

The Panel is optimistic about WARDA's future and visualizes a stronger and larger rice research Center in collaboration with IRRI and CIAT, WARDA's many NARS and international partners. The Panel also underlines the growing strategic importance of WARDA, noting that rice is the fastest growing food staple in sub-Saharan Africa, and that, in spite of the substantial increase in rice production and rising world prices, reportedly 32% of all rice exports now go to SSA. The SC concurs with the Panel, and joins it in suggesting that WARDA take advantage of the great opportunity for technological change provided by the increasing trend in rice prices. In order to meet that challenge, the Panel recommends that WARDA should place more emphasis on strategic research, not just because NERICAs are not a "silver bullet" that can solve all of Africa's rice production problems, but also because the genetic variability of African rices remains largely untapped, the genetic basis of NERICAs is too narrow, and NERICAs remain a "black box" with respect to the genetics and physiology that underlie their superior performance. The SC agrees with the Panel's recommendation of moving Center research into more strategic areas that will continue to support the NARES in the SSA, and believes that this is consistent with the SP concept.

The rising importance of rice in SSA is the rationale given by WARDA for its planned expansion into East and Central Africa, which initially contemplates increasing member states from 17 to 21. The Panel cautions that such expansion should be carried out in a phased manner, and includes a recommendation about this, which the SC appreciates. The Panel also notes that WARDA is under-staffed in many of the areas required to undertake a balanced strategic research agenda. The SC therefore cautions that WARDA should place more importance on the expansion of its strategic research agenda than on the expansion of its regional activities, in order to maintain focus in a phased period of growth. The panel rightly points out that partnerships should not/cannot substitute for the Center's own research capacity for strategic research.

The panel has provided many examples of where the growth in research needs to occur. It also highlights the benefits. A good example is seen in the cloning of the gene for yellow mottle virus, the application of which can begin to improve the efficiency of developing durable host plant resistance for that African pest by the NARES. The Panel has identified many other strategic areas of research that could have the same benefits: understanding the GXE of the region to define TPEs (target population environments) and then to set priorities around the constraints of each; modeling adaptive traits to further refine the targeting of priorities; fully exploiting the wealth of genetic and functional information that can now be released from the genetic resources of Africa; and defining a strategy for integrated weed, water and soil management. In supporting these recommendations, the SC suggests that the report could have been more forceful in defining the pathway for their implementation, and the SC offers the following three suggestions to that end.

First, the Panel made only passing reference to the alignment of Center activities to the SPs, indicating those to which the Center activities are aligned. However, the SPs are not just about the subject matter, they are more about focusing (i.e. prioritizing) Center resources on key strategic issues for which there is a higher likelihood of success. In many cases, this means Centers moving away from the more adaptive research to take on research of a more strategic nature. While the Panel's recommendations make this point, the Panel did not stress the fact that such strategic research needs to be linked back to and reinforced at the "system" level, and that WARDA needs to move away from a Center-centric view.

Second, the Panel recommends the addition of 4 staff and the filling of 2 vacant social sciences positions, in order to take up the new research agenda, and the Center has agreed to these increases. However, implementation will most likely imply decreases in other areas, and the Panel has not helped identify these areas. Furthermore, the change in the direction of the Center's research toward more strategic research and more NRM work, with the need for more and different staff, comes at a time that the Center is also growing geographically, which is also supported by the Panel. While in agreement with the Panel's recommendations, the SC is concerned about the feasibility of their implementation, and foresees that priorities will need to be set in order to manage all of this change with limited resources. Thus in the SC's view, WARDA needs to develop a 2-year business plan to ensure that these fundamental shifts take place in the best way possible. The SC recommends that the Board of the Center undertake to develop such a business plan, the implementation of which will be reviewed by the SC in 2 years.

Third, the Panel endorses the need for two Centers (IITA and WARDA) in the region, but it also notes progress made in governance and corporate services alignment between the Centers. The SC wonders, however, whether such alignment is enough, and whether there may be opportunities to exploit a greater alignment, particularly in the programmatic area. If WARDA (and the system) are to move upstream, why not conceive a joint program on bioinformatics that includes biometrics, or on weed management, or on water modeling and management, to name

as examples a few of the areas that the Panel identified which are in need of new expertise? The SC thus suggests that there is an opportunity for more joint implementation at the program level, in order to drive the resources needed for a change in the direction toward a more strategic agenda, in line with the CGIAR SP focus.

Research Program and Partnerships

The Panel notes that WARDA has conducted very relevant work, focusing both on genetic and non-genetic solutions to rice production systems in Africa. The Center has continued to use the products of the scientific breakthrough on the use of the African rice (*O. glaberima*) as an important new genetic source for the development of inter-specific rice cultivars for Africa. WARDA's scientists have combined this breakthrough with conventional breeding, with contributions from participatory plant breeding, to develop varieties adapted to local conditions. The networks developed by WARDA constitute an important platform for ensuring that the Center's scientific products are used by the local NARS. WARDA has also facilitated the development of seed systems through the African Rice Initiative (ARI), to alleviate the seed availability constraint in the pathway for more impact. The report states that, while WARDA has an excellent record of accomplishment of breeding work, research planning needs greater interdisciplinarity. The rice-growing environment in SSA is very heterogeneous and, until now, most of WARDA's technological solutions have been too generic and have relied too much on genetic improvement. There is therefore a need for better targeting of research activities, using a stratification of the biophysical and socio-economic environment. The focus should be on only a few constraints of regional importance, as it is more effective to produce varieties for targeted environments than releasing a wide range of varieties with unknown *GxE* performance. The SC concurs with the Panel on this, and adds that a fully integrated program on *GxE* interactions is needed, spanning upstream research to implementation. In addition, if the *GxE* studies are to be useful, a correlation of genotype data with phenotypic and productivity traits is required, the quality of which will depend on close attention to the capacity building of NARES staff. The *GxE* studies also have potential for increasing the output of high impact publications. How consistent this strategy is with the participatory plant breeding approaches employed by WARDA in the case of the NERICAs is moot however, and deserves critical examination by WARDA in the process of responding to these recommendations.

With regard to the integration of molecular marker technology into the breeding program, the SC notes the Panel's suggestions to upgrade throughput capability at Cotonou and to expand marker capacity at other breeding sites. Without wanting to enter the debate about centralization and outsourcing of marker technologies, the SC is aware that the CGIAR Genomics Taskforce, on which WARDA is ably represented, is, in the near future, intending to develop a 'Strategy for the delivery of genomics technologies by the CGIAR Centers over the next ten years'. The SC hopes that WARDA will await the advice and benefits available from such a strategy before investing too heavily in this area.

The Panel mentions the need for integration of participatory plant breeding into mainstream breeding. This aspect of the review relates to observations from other EPMRs, has systemwide relevance, and is currently under consideration by the SC. The SC has recently recommended the phasing out of the PRGA SWEP which is dominated by participatory plant breeding, essentially because the SWEP has done its job. Plant breeding at WARDA is a good example, showing the integration of PPB into conventional breeding, including, increasingly, the use of molecular approaches. The commentary in the report on the opportunity to further strengthen the statistical analysis of the information generated from the participatory work, and on ways to bring the local products of the PPB into a more formal seed system, is relevant for all rainfed (and perhaps irrigated) breeding programs. Indeed the report highlights the overall breeding approach for

variable environments using modern approaches of molecular tools, modeling of traits and genes, determining the TPEs, using diverse parental materials, and incorporating PPB along with the evolving information on innovation in seed systems. This is an area where the CGIAR might consider developing a concept paper to guide progress in rainfed environments.

The SC notes with surprise the Panel's doubts about the long-heralded claim that the NERICAs would have an ability to overcome weed problems by being much more competitive with them. Indeed this was a major rationale for the *glaborima* x *sativa* crosses. The SC believes that this issue deserves more research attention by WARDA as an input into its future research strategies and priorities, and that this should be informed by more multidisciplinary studies of adoption/constraints, which the Panel has recommended.

The Panel mentions the Center's gaps in social science research. The SC is in agreement with the Panel's recommendations to fill these gaps. However, the gaps in social science research supporting Center activities have also been pointed out in other EPMRs. The fact that they are also mentioned in this report is further confirmation of the need for the SC to undertake a stripe review in this area.

The System-wide Initiative on HIV/AIDS in Agriculture (SWIHA) is an important integrated, collective effort of several institutions seeking to spread information on this pandemic, and to improve nutrition in infected populations. (As the nutritional status of HIV/AIDS patients has an influence on the frequency and severity of opportunistic infections and disease progression, there are compelling reasons to contribute to good nutrition of patients.) However, the Panel concludes, and the SC concurs, that the activities being carried out by WARDA in SWIHA are not in areas where the Center has a comparative advantage, and recommends that the Center transfer its convening role to an institution whose core activity is in the area of HIV/AIDS and nutrition, which might be better equipped to serve the goals of the SWIHA initiative. Globally such institutions include UNAIDS, WHO, WFP and AED whose NARES or NGO partnerships seem to vary from one country and region to another.

The Panel suggests that the relatively low science productivity, measured by number of publications per scientist per annum, is not of great concern, considering the difficulties that the Center dealt with during the review period, perhaps because the Panel considers that, under such circumstances, this indicator does not reflect scientists' potential to perform. The above arguments notwithstanding, the SC questions whether doing "reasonably good research", in the Panel's words, is good enough for a "Center of Excellence", and will continue to monitor progress in this important indicator of science quality. The SC appreciates the report's highlighting of the need for more Quality Assurance (QA) in all aspects of the science, not just in laboratory procedures. The extent to which Centers have in place an overall QA program could be further explored as a means to improve the quality of science.

In summary

WARDA is to be congratulated for maintaining momentum during a difficult period in its history. The Science Council endorses the findings of the EPMR Panel's Report and agrees with its recommendations. The SC welcomes the recent alignment with IRRI and CIAT on rice, and encourages WARDA to adopt a strategic view towards its own research on rice for African environments, taking advantage of the specific opportunities identified in the Panel's report. There should be constant efforts to assess and enhance all aspects of science, and not to overstretch critical mass by too rapid an expansion to east and southern Africa. The SC hopes that WARDA will utilize opportunities (such as shared posts) for linking with IITA and regional partners where it is sensible to do so.

August 3, 2007

Professor Rudy Rabbinge
Chairman Science Council
Wageningen Agricultural University
P.O. 102
Wageningen Gelderland 6700 AC
The Netherlands

Dr. Ren Wang
Director CGIAR
The World Bank
1818 H St NW
Washington DC 20433, USA

Dear Rudy and Ren,

On behalf of Africa Rice Center (WARDA) Board of Trustees and Management, we herewith transmit our response to the recommendations on the fifth External Program and Management Review (EPMR). We wish to express our utmost appreciation to the EPMR panel chair and members for their valuable in-depth analysis constructive comments and perspective on the Center. We are grateful that the review was conducted in a participatory and transparent manner. We thank the Secretariats of the Science Council and the CGIAR for organizing and facilitating the review.

The Board and Management agree with most of the recommendations and suggestions and look forward to discussing these at the August meeting of the Science Council. We note that the panel endorses the continuing need for WARDA because rice has become the most rapidly growing food source in sub-Saharan Africa and the Center's mission remains relevant to addressing poverty reduction.

The Board concurs that WARDA has conducted very relevant work focusing both on genetic and non-genetic solutions to improving sustainable rice production systems in Africa. However the Center needs to place more emphasis on strategic rather than applied research. We also agree that steps need to be taken to improve critical mass and that detailed large-scale phenotypic evaluation of *O. glaberrima* and its valuable traits is needed. The panel observes and the Board agrees that NERICAs have been viewed as a 'silver bullet' and that in the future WARDA should 'increase its wider impact through a broader product portfolio based on better stratification of rice growing environments.

The panel pointed out and Board accepts that there is a need to strengthen WARDA's research on water management and for a strategy for weed management to be developed. Concerning social science research, the Board is pleased to note that adoption and impact studies have been rated excellent and that WARDA could capitalize on its Council of Ministers (CoM) and National Experts Committee (NEC) mechanism to promote policy and development frontiers. Similarly, the panel commends WARDA's partnership model for its positive outcome but cautions on the potentially high transaction costs.

The Board welcomes the Panel's findings that the Center is well established at its temporary headquarters in Cotonou and that the research program has been maintained despite two relocations. We also endorse the panel's conclusions that the Center has weathered the Ivorian crisis remarkably well; has been guided by an effective Board and Senior Management. We also agree that continued evolution of the research program and administration would need careful

guidance from the Board. The panel's statement that the Center has performed well in the CGIAR performance measurement system that includes governance, financial health and management parameters augurs well for the Board's planned alignment of corporate services between ITTA (BENIN) and WARDA to be completed by the end of 2007. Programmatic alignment between CIAT-IRRI-WARDA is equally on-course.

The Board also welcomes the Panel's recommendations for the creation of four new scientific positions, and agrees with their critical importance. The implementation of these recommendations will require either additional funding or a redeployment of the current resources, or a combination of both. While the Board and management will address these recommendations, a prioritization will be necessary.

Finally we are encouraged that the panel envisages the WARDA of tomorrow as a stronger and larger rice research center serving all of sub-Saharan Africa in collaboration with NARS and international partners. We have learnt a lot from the review and will benefit from the report including feedback from the CGIAR as we implement the recommendations.

Sincerely yours,



Papa A. Seck
Director General



Gaston Grenier
Board Chair

**RECOMMENDATIONS OF THE 5TH EXTERNAL PROGRAM AND MANAGEMENT
REVIEW OF THE AFRICA RICE CENTER (WARDA)
AND RESPONSES BY THE CENTER'S BOARD AND MANAGEMENT**

The Panel recommends that:

Rice genetic improvement

1. Because phenotypic variability of *O. glaberrima* has not been studied as extensively as that of *O. sativa*, the Panel recommends exploring more systematically the phenotypic variability of *O. glaberrima* for desirable traits, using sound, up to date screening methods, focusing on processes and mechanisms of these traits.

Response

ACCEPTED: WARDA is currently phenotyping *O. glaberrima* accessions using the latest screening techniques to identify desirable traits, and agrees to explore more thoroughly the diversity in *O. glaberrima* from its genebank.

2. To capitalize on the excellent work done on the understanding of the genetic structure of *O. glaberrima*, the Panel recommends that the Genetic Resources Unit, breeders and molecular biologists of WARDA collectively focus on defining core collections of *O. glaberrima*, i.e. collections of accessions representative of the diversity of the whole species.

Response

ACCEPTED: WARDA agrees to develop, through a concerted interdisciplinary effort, a core collection of *O. glaberrima* accessions, using the earlier characterization of accessions as a starting point.

3. Since the interspecific hybridization sterility problem has been solved, the Panel recommends that WARDA greatly broaden the set of *O. glaberrima* and *O. sativa* accessions used as parents in interspecific hybridizations, using the results of phenotypic and molecular characterizations to ensure larger diversity of parents, monitoring closely the level of introgression and the genetic diversity of the released progenies. The creation of a first generation of interspecific hybrid progenies (NERICAs) should not be seen as the end, but as the beginning of a great "genetic adventure" aimed at making the best possible use of the African gene pools (*O. glaberrima*, *O. sativa* and other species).

Response

ACCEPTED: WARDA strongly welcomes this recommendation. Work has already started along these lines, with crosses that incorporate *O. barthii*, *O. glaberrima* and *O. sativa* in upland and lowland NERICA progenies.

4. The Panel recommends that WARDA seek to secure, on a sustainable basis, the funding of INGER-Africa, which is a network essential for the diffusion of genetic progress. The Panel further recommends that INGER-Africa clearly focus on understanding Genotype x Environment interaction patterns across testing sites, and capitalize on the benefits that derive from it.

Response

ACCEPTED: WARDA fully agrees with this recommendation and in partnership with IRRI and CIAT is aggressively seeking additional funds to sustain INGER-Africa.

NRM

5. The panel recommends that WARDA: (1) recruit without delay two scientists, in irrigation engineering/hydrology and in crop-water modeling/land use-planning, respectively; (2) develop a strategy to mainstream water management research into the Center's core research program; and (3) help strengthen the capacity of national organizations for conducting research on the rice-water-soil interfaces, in collaboration with IWMI and other relevant partners.

Response

ACCEPTED: WARDA is (1) recruiting a crop-water modeling/land-use planning specialist and will explore re-establishing the joint position of water management specialist with IWMI; (2) will develop a strategy for water management; (3) help strengthen the capacity of national organizations for conducting research on the rice-water-soil interfaces in consultation with IWMI, IVC and regional centers within the framework of the Regional Plan for Collective Action (REPCA).

6. The Panel recommends that WARDA develop, in collaboration with weed scientists from advanced research institutions, a strategic vision for future research in weed management, and revisit its decision to focus almost entirely on the expected weed competitiveness of NERICAs.

Response

ACCEPTED: WARDA agrees to develop in collaboration with ARIs and CGIAR centers an in-depth strategic approach to research on weed science. WARDA's cropping systems agronomist will focus more on wider aspects of weed research to correct the Panel's impression that the Center has confined itself to the weed competitiveness of NERICAs.

Quality and relevance

7. In order to improve the priority setting process, the Panel recommends that WARDA collect relevant background information, assign appropriate weights to the constraints identified, focusing only on a few major constraints of regional interest for each rice ecosystem, and better define homogeneous target areas (e.g. through stratification of the biophysical and socio-economic environments).

Response

ACCEPTED: WARDA recognizes the need for a more systematic approach to its priority setting supported by more precise data on biophysical and socioeconomic constraints. Information on existing constraints and their weighting will be based on results from characterization, adoption and impact studies.

8. The Panel recommends that WARDA allocate more time and resources to development of concepts and methodologies, and to understanding genetic and physiological mechanisms and processes responsible for superior performance in the appropriate genetic backgrounds (*O. sativa*, *O. glaberrima*, or NERICAs, according to the situation).

Response

ACCEPTED: WARDA agrees with the recommendation and will invest significant effort in this area.

9. In order to ensure that available scientific talent is utilized primarily for science, and in order not to compromise research quality, the Panel recommends that WARDA make every effort to achieve a reasonable balance between in-house scientific activities and external network or partnership activities that focus more on development than on research.

Response

ACCEPTED: WARDA will focus on strategic research to generate IPGs, cognizant of its comparative advantage, the roles of NARES and development partners, and the need for critical mass. The New Vision of WARDA requires that scientists spend 80 percent of their time on research and 20 percent on other activities, including partnerships.

Social sciences

10. Because of research gaps in the social sciences research program (policy analysis, rainfed production economics, adoption studies), the Panel recommends that WARDA recruit a rural sociologist and fill other positions in the social sciences (production economist, policy economist) in a timelier manner.

Response

ACCEPTED: WARDA will shortly recruit a sociologist, policy economist and production economist. Meanwhile, two agricultural economics professors were appointed in March 2007 as part-time visiting scientists.

Research support

11. The Panel recommends that WARDA make the necessary investments and provide funds on a regular basis to ensure communications (e-mail and internet) that meet the performance standards expected at an international research institute, both at its headquarters and outstations.

Response

ACCEPTED: WARDA has committed additional investment to resolve the issue of narrow bandwidth currently affecting its communications capacity. This effort is taking place in collaboration with the CGIAR ICT-KM group and with IITA as part of the alignment of Corporate Services in Cotonou. Concrete results are expected before the end of 2007. Connectivity in the outstations will also remain a priority.

12. Because good statistical design and analysis is an essential component of research quality, the Panel recommends hiring as soon as possible one full time biometrician, preferably with good

experience in Genotype x Environment interaction analysis, design of on-farm field trials, and analysis of survey data coming from Participatory Varietal Selection.

Response

ACCEPTED: WARDA agrees to recruit a suitably qualified, full-time biometrician to replace the current part-time biometrician.

Partnerships and linkages

13. The Panel recommends that WARDA develop a medium and long term strategy for a phased expansion in Central, East and southern Africa, in line with available funds, without compromising critical mass in West Africa. Moreover, the programmatic alignment of WARDA with IRRI in East and southern Africa should specify their respective roles based on their respective comparative advantages.

Response

ACCEPTED: WARDA fully agrees to develop a strategy for a cautious and phased expansion in Central, East and southern Africa based on additional financial support from new member countries and pledges from major donors. By making full use of the strong links established with IRRI and CIAT, the Center will ensure that critical mass in West Africa is not compromised.

14. Because the System Wide Initiative on HIV/AIDS (SWIHA) is not expected to contribute to WARDA's core research outputs, the Panel recommends that WARDA transfer its convening role to a partner more suited to leading the SWIHA initiative.

Response

ACCEPTED IN PRINCIPLE: The Center will explore with the Alliance sustainable options for SWIHA, taking into account the supportive Science Council Commentary of 2005 on SWIHA, the alternative windows for efficiency of inter-center collaboration via SWEPS, and the prevailing alignment with REPCA-WCA/ESA. The discussions will be informed by the history behind the origin of SWIHA, and the logic for its hosting and orientation in SSA. HIV/AIDS may not be at the core of WARDA's research program but it has immense impact on agriculture and future food security in SSA.

Adoption and impact

15. Because technology generation must take into account the heterogeneity of the environments and the farming populations, including the different needs of farmers, for better targeting of technologies and better adoption, the Panel recommends that WARDA, in its adoption and impact studies, involve suitable interdisciplinary teams from its research program (breeding, natural resource management, socio-economics).

Response

ACCEPTED: WARDA agrees with this recommendation and recognizes the need for better understanding of the technological, sociological and institutional constraints to adoption. By closely involving scientists from relevant disciplines, the Center will ensure an effective feedback

mechanism for integrating the results of its adoption and impact studies into technology development and targeting.

Governance and Management

16. The Panel recommends that the Program Committee augment its resources by relying on an external Board-appointed Scientific Advisory Committee (SAC) comprised of 3-4 outstanding scientists with knowledge of rice and/or other cereals from around the globe, which would provide in-depth guidance on technical quality and strategic directions of science undertaken by WARDA.

Response

ACCEPTED: WARDA concurs that strategic scientific advice to the Program Committee be strengthened. It is proposed to allocate more time (at least two days) during Board meetings for Program Committee matters, and to ensure Board membership includes individuals with expertise in rice science. A SAC of 3-4 outstanding scientists reporting to the Program Committee Chair will provide valuable insight during annual research planning days and the National Experts Committee meetings, as well as strengthening the in-house peer review system of programs and projects.

17. The Panel recommends that the Financial Procedures Manual (which was last issued in 2001) be updated and suitably revised, as needed, and that compliance with these procedures be ensured by the Board and Management so that the financial control environment operates as intended.

Response

ACCEPTED: WARDA agrees to update the Financial Procedures Manual and that the Board and Management will ensure due diligence.

18. The Panel recommends that the staff and heads of Corporate Services of WARDA and IITA: a) continue a very collaborative approach to ensuring that the transfer/alignment of corporate services proceeds smoothly; b) closely monitor on a regular basis the progress made by the various Transition Task Forces, Steering Committee, and the Local Implementation Committees at Cotonou and other sites covered by the Memorandum of Agreement; and c) seek to benefit from the experience of other Centers that are aligning corporate services. Nevertheless, it cautions WARDA that in seeking efficiency gains from the alignment of corporate services, it ensures that research quality and relevance are not compromised, and that scientists continue to have access to adequate technical support during and after the alignment process.

Response

ACCEPTED: WARDA Board and management fully agree that research quality and relevance should not be compromised in seeking “efficiency gains” while recognizing the need for costs effectiveness in WARDA’s service to science. Efforts are underway to implement this recommendation.

Prof. Roelof Rabbinge
Chair, Science Council
Consultative Group on International Agricultural Research
Wageningen UR,
Lawickse Allee 11
6701 AN Wageningen, The Netherlands

Dr. Ren Wang
Director
Consultative Group on International Agricultural Research
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433, USA

ET/jv/2007016

2007-08-03

Dear Prof. Rabbinge,
Dear Dr. Wang,

On behalf of the Panel, I am pleased to transmit hereby to you the Report of the Fifth External Program and Management Review (EPMR) of the Africa Rice Center (WARDA). The Panel has reviewed WARDA's performance from all angles, and particularly its research program, relevance and quality of science at WARDA, partnerships and linkages, adoption and impact, governance and management, according to the Terms of Reference. We also paid special attention to WARDA as an Association of 17 African states, as WARDA is also an inter-governmental organization, created in 1971, which existed prior to joining the CGIAR in 1987. We also addressed the 18 strategic issues received from the Science Council.

Since the 4th EPMP, completed in 2000, WARDA has experienced the "Ivorian crisis" in 2002 and 2004, with a forced relocation of the Center's headquarters from Côte d'Ivoire to Mali (and Abidjan), a failed return in 2004, and then to the IITA-Cotonou station in Benin in 2005. The Center is now well established at its temporary headquarters in Cotonou, and as part of the alignment of corporate services with IITA, the provision of corporate services for both Centers at Cotonou will be the responsibility of WARDA. When WARDA moved to Cotonou in January 2005, a planning horizon of at least five years was defined by the Board of Trustees, in order to ensure stability of staff and program. Thus, the earliest return to Bouaké will be in 2010 or 2011 in the best of circumstances regarding political stability and security in Côte d'Ivoire. A second failed return cannot be permitted.

Our overall conclusion is that the Center has weathered the "Ivorian crisis" remarkably well, has been guided by an effective Board of Trustees, has been ably led by its senior managers, has continued to do reasonably good research, maintained functioning corporate services, and is now poised to launch a period of phased growth.

Rice has now become the most rapidly growing food source in Sub-Saharan Africa (SSA). Relative growth of demand for rice is faster in SSA than anywhere else in the world, more than double the population growth. And imports are still rising. As a result, the Member States of West Africa and other SSA countries in Central, East and southern Africa, have very high expectations about WARDA. The more intensive program collaboration which is now planned with IRRI and CIAT on rice research is very timely and the Panel commends all involved for recent progress made in this regard.

On program relevance and quality, WARDA has conducted very relevant work focusing both on genetic and non-genetic solutions to rice production systems in Africa. The performance could however be greatly improved if the current research priority setting process is improved, and research

planning incorporates greater interdisciplinarity. The 2003-2012 strategic plan was prepared during the Ivorian crisis and the process was less rigorous than required. There is a need for better targeting of research activities, using a stratification of the biophysical and socio-economic environment, focusing only on a few constraints of regional importance. The rice growing environment in SSA is very diverse and until now, most of WARDA's technological solutions (NERICA as a "silver bullet") have been too generic. Appropriate crop and natural resource management solutions should be specifically developed and disseminated for specific target areas, ensuring better adoption. The Center needs to place more emphasis on strategic rather than applied research, and there is a need for a better balance between breeding and natural resource management research. WARDA is understaffed in some areas of research and steps need to be taken to improve critical mass. In this respect, WARDA always refers to its partnership mode of operation with the NARS, but WARDA needs to move more upstream, and learn more from its partners, particularly from downstream Genotype X Environment interactions, and use this feedback more systematically in its own research.

Governance at WARDA is reasonably good, though program oversight could be improved. The Center is still in transition - with a new Director General, a new "vision" and a research organization introduced by him soon after taking office, and several new staff in key positions. A new Assistant Director General for Research and Development will be appointed soon upon retirement of the current incumbent. Thus, over the next 3-5 years, WARDA needs stability and consolidation.

A total of eighteen recommendations have been formulated and they should help the Center improve its performance. The Panel is optimistic about WARDA's future and visualizes a stronger and larger rice research Center serving all of SSA, in collaboration with IRRI and CIAT, and WARDA's many NARS - and international partners. We strongly recommend that the members of the Association and the donors further support and invest in the Center for this purpose. However, WARDA needs to be cautious about expansion and there is a specific recommendation about it.

Finally, the Panel members, including the consultants, appreciate the opportunity offered to participate in this Review, thank WARDA's Board, management, staff and the NARS partners for their collaboration, transparency, openness and availability in this exercise, and thank the Science Council for its support, particularly through Beatriz Avalos-Sartorio, Panel Secretary.

We hope the Report will be used by WARDA and its partners, as well as the CGIAR, to guide and improve future rice research and development in SSA.

Yours sincerely,

Eric Tollens
Panel Chair

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
SCIENCE COUNCIL AND CGIAR SECRETARIAT

**Report of the Fifth External Program and Management Review (EPMR)
of the Africa Rice Center (WARDA)**

Review Panel: Eric Tollens (Chair)
Zelia Menete
Pammi Sachdeva
Brigitte Courtois
Mary Ncube (Consultant)
Toshihiro Hasegawa (Consultant)

SCIENCE COUNCIL SECRETARIAT
AUGUST 2007

CONTENTS

SUMMARY.....	1
RECOMMENDATIONS.....	5
1. INTRODUCTION, BACKGROUND AND CONTEXT	9
1.1 Africa’s rice economy	9
1.2 WARDA’s mission and as a research for development institution	13
1.3 The general organization of WARDA.....	14
1.4 The “Ivorian crisis”	14
1.5 Key developments since the fourth EPMR.....	15
1.6 Evolution of WARDA: strategic and medium term plans, research program structure, research organization by location, CGIAR system priorities	18
2. RESEARCH PROGRAM	25
2.1 Rice genetic improvement	25
2.2 Agro-physiology	43
2.3 Rice agronomy and natural resource management	45
2.4 Social sciences at WARDA.....	58
2.5 Training and capacity building.....	63
2.6 Research support.....	65
3. RELEVANCE AND QUALITY OF SCIENCE.....	71
3.1. Relevance of science	71
3.2 Quality of science	76
4. PARTNERSHIPS AND LINKAGES	85
4.1 Links with NARS and networking, including extension to ESA	85
4.2 Links with other CGIAR Centers and Challenge Programs	92
4.3 Links with Advanced Research Institutes	95
4.4 Links with NGOs, civil society and the private sector (seed partnerships)	95
4.5 Conclusions.....	96
5. ADOPTION AND IMPACT	97
5.1 A new methodology for adoption studies.....	97
5.2 Adoption and impact studies.....	98
5.3 Determinants of adoption.....	99
5.4 Constraints to adoption.....	99
5.5 Impact culture and measures of impact	101
5.6 Institutional innovations in seed systems	102
5.7 Policy dialogue	103
5.8 Conclusions.....	104
6. GOVERNANCE AND MANAGEMENT	107
6.1 Governance.....	107
6.2 Management	119
6.3 Corporate services	131
6.4 Changes in Staff Profile.....	132
6.5 Alignment of corporate services with IITA.....	133
6.6 WARDA's planned return to Côte d’Ivoire.....	135
6.7 Concluding comments on Governance and Management.....	136

7.	WARDA TOMORROW	137
7.1	The Context.....	137
7.2	WARDA's comparative advantage	137
7.3	Rice Technology Generation and Dissemination - the Scientific Challenge.....	137
7.4	NRM	138
7.5	Seed Production	138
7.6	The Policy Environment	138
7.7	Training and Capacity Building	139
7.8	Future scenarios	139

FIGURES

Figure 1.1	Evolution of International Rice Prices, 2000-2007 (FOB export basis).....	10
Figure 1.2	Evolution of paddy rice yields in Sub-Saharan Africa (1961-2006).....	12
Figure 1.3	Organizational structure – Africa Rice Center.....	16
Figure 1.4	The Structure of the Research Programs	19

TABLES

1.1	Estimation of rice production trend by each rice production ecology in West Africa during 1984 and 1999/2003.....	12
1.2	Research staff numbers according to locations	21
1.3	WARDA's resource allocation by CGIAR system priorities (US\$ million).....	22
2.1	Ecosystems – biophysical constraints to increased rice productivity and profitability.	46
2.2	Social science research team at WARDA	62
2.3	Short Courses and Individual-level Training Activities at WARDA (2002-2006).....	64
2.4	Number of persons trained by WARDA 2001-2006	64
3.1	Allocation of WARDA resources, 2003-2012, according to rice agro-ecologies.....	73
3.1	Number of Publications (*) of WARDA scientists (**) by Year and Research Area.....	77
3.2	Scientists' productivity for the previous five years for the IRS-R that were present in 2006: WARDA and the CGIAR.....	78
3.4	Varieties adopted and/or released during the 2000-2006 period.....	81
4.1	Critical Mass through ROCARIZ Task Forces	86
4.2	Production and distribution of NERICA Foundation Seed by ARI Coordination Unit.....	88
4.3	NERICA upland lines adopted/released in selected countries.....	89
5.1	Summary results of the adoption and impact studies in three countries.....	98
6.1	Africa Rice Center (WARDA), Board Composition 2001-2007	113
6.2	WARDA's Funding and Performance Indicators—1999-2006.....	125
6.3	WARDA's Grant Income for 2006 (US Dollars)	126
6.4	Member States Contributions (and Arrears) to WARDA	126

ANNEXES

1	WARDA 5th EPMR Panel Composition and Biodata.....	A-1
2	(a): Guidelines for External Programmed and Management Reviews of CGIAR Centers, including Terms of Reference for External Programmed and Management Reviews of CGIAR Centers.....	A-5

2 (b). Terms of Reference for the Financial Management Consultancy.....	A-13
3 Strategic Issues for the 5th Africa Rice Center EP MR.....	A-14
4 Itinerary of the EP MR Panel (Schedule of the Initial and Main Phases, and Field Visits).....	A-16
5 People Contacted/Interviewed by the Panel.....	A-17
6 List of documents reviewed by the Panel.....	A-25
7 4th WARDA EP MR Recommendations: WARDA’s Response and Panel Comments.....	A-34
8 Evolution of real rice prices to producers in Africa’s main rice producing countries 1991-2005.....	A-42
9 The Ivorian crisis.....	A-43
10 (a): Visit to Senegal, 24 to 26 June 2007, Brigitte Courtois, Zelia Menete, Eric Tollens.....	A-45
10 (b): Visit to Mali, 29-30 June 2007, Brigitte Courtois, Zelia Menete, Eric Tollens.....	A-47
10 (c): Visit to Uganda, Zelia Menete and Eric Tollens, 11-15 June, 2007, Status of NERICA Dissemination in Uganda.....	A-48
11 Staff time allocation for each project and discipline.....	A-50
12 Number of journal articles published by WARDA scientists per years. Impact factor (average 2002-2004) and Rank in the discipline of these journals.....	A-55
13 WARDA’s Funding Structure, 2000-2006 (US\$ Thousands): Restricted vs. Unrestricted Grants.....	A-58
14 WARDA’S 5th EP MR: Staff Perceptions Survey	A-59
15 Africa Rice Center (WARDA) Stakeholder Survey	A-60
16 Acronyms and Abbreviations.....	A-64

SUMMARY

Introduction

This 5th External Program and Management Review (EPMR) of WARDA (Africa Rice Center) comes at an important transition point in its recent history. The 4th EPMR, completed in 2000, was unfortunately followed in 2002 by a forced relocation of the Center's headquarters from Côte d'Ivoire to Mali, and then to Benin in 2005. The Center is now well established in its temporary headquarters in Cotonou, and the research program has been maintained despite the two relocations. The current period of transition is the result of a change of leadership at the Center in October 2006, the implementation of the new Director General's "vision" for the Center, and WARDA's ongoing realignment of the Center's program, governance and corporate services with other CGIAR Centers, primarily IRRI and CIAT (for programmatic matters) and IITA (for governance and corporate services).

The Panel's report covers these and other areas, in accordance with the EPMR's terms of reference. We also address the strategic questions formulated by the Science Council to help direct the Panel's attention to key issues facing the Center. The implementation of the recommendations of the 4th EPMR indicates that most of these recommendations have been implemented or were overtaken by events (see Annex 7).

Our overall conclusion is that the Center has weathered the "Ivorian crisis" remarkably well, has been guided by an effective Board of Trustees, has been ably led by its senior managers, has continued to do reasonably good research and maintained functioning corporate services, and is now poised to launch a period of phased growth. Such growth would emphasize high quality scientific research in partnership with the NARS of Africa and advanced research institutions elsewhere.

This continuing evolution of the research program and administration would, however, need to be carefully guided by the Board and effectively and efficiently managed by Center leadership and staff. The Panel hopes that its review of all major aspects of the Center, the analyses done and conclusions reached by the Panel, and the suggestions and recommendations made in various sections of this report will help the Center progress steadily toward an exciting future.

The Continuing Need for WARDA

During the last decade, rice has become the most rapidly growing food source in Sub-Saharan Africa (SSA). Relative growth for demand for rice is faster in SSA than anywhere else in the world. This is due to population growth and a shift in consumer preference for rice, especially in urban areas; and this is happening in West and Central Africa (WCA) as well as in East and Southern Africa (ESA). In West Africa, 29% of the total production of rice in 1999/2003 was from the upland ecosystem, 36% from the lowland ecosystem, and 26% from irrigated fields.

WARDA has rice research programs in these three ecosystems; and works closely with its regional and national partners. It is in a position to contribute to rice development, which, according to CORAF/WECARD's Strategic Plan (2000) and a recent study by IFPRI-IITA-CORAF/WECARD and ECOWAS (2006), is potentially the best driver of development for SSA—the locomotive that will pull growth and poverty reduction in the sub-region. In the Panel's view, WARDA's mission, aimed at increasing the productivity and profitability of the rice sector while ensuring the sustainability of the farming environment, remains relevant and appropriate.

Main Findings and Conclusions

The Panel's main findings and conclusions are detailed in the various chapters of the report. Selected highlights are provided below:

Program relevance and quality: WARDA has conducted very relevant work focusing both on genetic and non-genetic solutions to rice production systems in Africa. The achievements are many, and are in line with its mission and CGIAR system priorities. The relevance and the quality of science at WARDA could, however, be greatly improved if the current research priority setting process is improved, and research planning incorporates greater inter-disciplinarity. There is a need for better targeting of research activities, using a stratification of the biophysical and socio-economic environment, focusing only on a few constraints of regional importance. Then, appropriate crop improvement and NRM management solutions could be specifically developed and disseminated to the target areas, ensuring better adoption by farming communities.

Resource allocation between the major rice ecologies is satisfactory, and responds to the need for intensification of research on the irrigated and rainfed lowlands. The Center needs to place more emphasis on strategic rather than applied research, and should identify and strengthen strategic partners for product delivery. Moreover, a better balance between breeding and NRM research activities should be ensured. WARDA's role should be better demarcated from that of NARS, based on their respective missions and comparative advantages.

Very good progress has been made in the implementation of measures to ensure quality of science. Good progress has also been made in terms of the development of rice varieties. The publication record of WARDA is good in number and in quality, though the number of papers per scientist is somewhat below the average for CGIAR Centers. WARDA is under-staffed in some areas of research. Steps need to be taken to improve critical mass, and to use researchers primarily for scientific rather than networking activities.

Genetic improvement program: The Panel notes that 18 upland, 60 lowland and 3 irrigated varieties of NERICA (New Rice for Africa), and several additional *Oryza sativa* varieties have been developed and released during 2000-2006; and that there has been a large improvement in the rate of success of interspecific crosses between *O. glaberrima* and *O. sativa*, the two parents of NERICAs. Excellent work has been done on the genetic diversity of *O. glaberrima*. But further in-depth large-scale phenotypic evaluation of its valuable traits is needed. The future objectives of this work could be to establish core collections of *O. glaberrima*, and to undertake genome association mapping to locate genes with precision and to identify interesting alleles at these genes.

NERICAs have so far been viewed as a "silver bullet". However, in order to broaden impact, there is need for improved stratified analyses of the environment (agro-ecological as well as socio-economic) and a definition of homogeneous target zones with their associated ideotypes. The results of this stratification should be factored into Participatory Varietal Selection approaches, in order for breeders, agronomists, and socio-economists to better understand the reasons behind the variability of varietal performances and farmers' choices.

During the review period, very good collaborative work has been done on the understanding of the genetic control of some traits, leading to the cloning of a RYMV resistance gene. Similar work has started for the major abiotic stresses. All elements, including the availability of several useful genes, are in place for NARS to begin marker-aided selection programs.

Natural resource management: WARDA's research on NRM addresses the main soil, nutrient, water, weed, pest and disease constraints in West Africa. In the Panel's view, this work is relevant, of good scientific quality, and needs to be given more emphasis in the future (including in the Center's documentation and communication efforts). In terms of future NRM research at WARDA, since the mechanisms and processes behind NERICAs' productive potential are generally unknown, the Panel suggests research in a number of areas, including a better understanding of mechanisms associated with nutrient-use efficiency, water-use efficiency and productivity, resistance to pests and diseases, protein content, and weed competitiveness. It is important that the target trait be well defined, and that the traits of progenies be examined agro-physiologically.

The cropping systems approach to agronomy research is appropriate, but future work should focus on development of crop and natural resources management practices that lead to sustainability of yields (maintain or improve crop productivity in the medium- and long-term) and land resources. In view of the growing water scarcity and competing demands between agriculture and other uses, there is need to strengthen WARDA's research on water management to improve rice productivity, including research on institutional and policy issues of irrigation systems and their impact on water costs and the profitability of rice production. WARDA needs to strengthen critical mass in this area, both at Center and at national institutions. A strategy for weed management for the rainfed lowlands and uplands is also needed, as WARDA until now has mainly focused on NERICAs' presumed weed competitiveness, something that the Panel could not confirm during field visits. More work on integrated pest management is also needed.

Social sciences and adoption and impact studies: WARDA's social scientists have been doing good social science research, including research on adoption and impact. Notable examples are the Participatory Learning and Action Research (PLAR) method for technology transfer, and a new methodology for undertaking adoption studies. However, WARDA's adoption and impact studies have been limited by their "snapshot" approach. More generally, the Panel had difficulty understanding the results of WARDA's adoption and impact studies, perhaps because the agro-ecologic and socio-economic contexts of such studies are not sufficiently clear and explicit. So many constraints operate on adoption that involving interdisciplinary teams from WARDA's other research programs may help. In addition, while the Agricultural Policy Research Advocacy Group (APRAG), WARDA's Council of Ministers (COM) and National Experts Committee (NEC) are very good mechanisms to influence policy, they require a sharper focus on rice policy and its links to agricultural development. The feedback of the results of such studies to the technology developers, particularly breeders also seems to be lacking. The Panel feels that had several social science staff positions not remained vacant for so long, the contribution of social sciences would have increased and improved significantly.

Finally, the seed issue remains a critical constraint, and WARDA needs to delve into understanding farmers' rationale for purchasing and storing seed. There is a need for better data on areas under modern rice varieties, on improved agronomic practices, and rice markets and policy. A multi-agency workshop on the issue is suggested.

Training and capacity building: Training and capacity building are an integral part of the research program at WARDA, particularly since many NARS are still weak and lack well-trained staff. WARDA has put a major effort into training of NARS scientists in breeding, including using molecular techniques, but NRM training, particularly on soil and water management, needs attention in the future. The Panel endorses the newly proposed post-masters internship program as an innovative approach. However, more and better linkages with higher education institutions

in Africa should be sought, including linkages complementing outsourcing of training activities for NARS.

Partnerships: WARDA embraces and values networks and partnerships, and this is to be commended. “Partnerships at all levels” is a WARDA motto, and the Panel has confirmed that this is not an empty phrase. “WARDA, that is us”, as said by its partners, typifies their special relationship with the Center. On the many questions regarding critical mass, WARDA’s responses invariably included NARS scientists.

However, while the outcomes of partnerships and networks are unquestionably positive, they have come at high transaction costs. In the Panel’s view, partnerships should not substitute the need for critical mass at WARDA, to guarantee science quality. Furthermore, WARDA’s specific role in its partnerships needs to move upstream, seeking collaborations that are more science oriented. At the same time, WARDA needs to learn more from its partners, from their field experiences and the downstream Genotype x Environment interactions, and use this feedback more systematically in its own research.

Governance and management: The Panel notes that during the period under review, WARDA has had to face extraordinary circumstances beyond its control. The 4th EPMR recommendations on governance and management have largely been implemented, or were overtaken by events. The difficulty of guiding and managing a Center repeatedly uprooted from its home country and headquarters location due to violent civil unrest should not be minimized, nor should the time and effort needed to firmly re-establish it on a firm footing in subsequent years. WARDA has only now emerged from this five-year period of uncertainty and flux. In spite of this, in recent years, WARDA has performed reasonably well in terms of the CGIAR Performance Measurement System that includes a comparative assessment of governance, as well as financial and other management-related performance measures included in the CGIAR report for 2006.

In the Panel’s view, governance at WARDA is reasonably good, though program oversight could be improved. Management of research and corporate services has improved, but there is room for further strengthening in several areas. The Center is still undergoing a further period of transition — with a new Director General, a new “vision” and a research organization introduced by him soon thereafter, and several new staff in important positions. In addition, it is expected that the planned alignment of corporate services between WARDA and IITA (Benin) will be completed by end-2007; a new ADG for Research and Development will be appointed upon the retirement of the current incumbent sometime during 2008; and programmatic alignment between WARDA and other CGIAR Centers will accelerate.

It seems to the Panel that during the next 3-5 years, WARDA would benefit from a period of Board-guided and Management-orchestrated stability and consolidation phase, which would nevertheless introduce necessary changes in governance and management in a systematic and prudent manner. The Panel believes that once these changes are in place, WARDA will have the capacity to deliver on a more ambitious rice research program, enhanced and strengthened by the collaboration with IRRI and CIAT, in the coming years.

WARDA tomorrow: The Panel is optimistic about WARDA’s future. It visualizes a stronger and larger rice research Center serving all of Sub-Saharan Africa, in collaboration with WARDA’s many NARS and international partners.

RECOMMENDATIONS

Rice genetic improvement

Because phenotypic variability of *Oryza glaberrima* has not been studied as extensively as that of *O. sativa*, the Panel recommends exploring more systematically the phenotypic variability of *O. glaberrima* for desirable traits, using sound, up-to-date screening methods, focusing on processes and mechanisms of these traits.

To capitalize on the excellent work done on the understanding of the genetic structure of *O. glaberrima*, the Panel recommends that the Genetic Resources Unit, breeders and molecular biologists of WARDA collectively focus on defining core collections of *O. glaberrima*, i.e. collections of accessions representative of the diversity of the whole species.

Since the interspecific hybridization sterility problem has been solved, the Panel recommends that WARDA greatly broaden the set of *O. glaberrima* and *O. sativa* accessions used as parents in interspecific hybridizations, using the results of phenotypic and molecular characterizations to ensure larger diversity of parents, monitoring closely the level of introgression and the genetic diversity of the released progenies. The creation of a first generation of interspecific hybrid progenies (NERICAs) should not be seen as the end, but as the beginning of a great "genetic adventure" aimed at making the best possible use of the African gene pools (*O. glaberrima*, *O. sativa* and other species).

The Panel recommends that WARDA seek to secure, on a sustainable basis, the funding of INGER-Africa, which is a network essential for the diffusion of genetic progress. The Panel further recommends that INGER-Africa clearly focus on understanding Genotype x Environment interaction patterns across testing sites, and capitalize on the benefits that derive from it.

Natural resource management

The Panel recommends that WARDA: (1) recruit without delay two scientists, in irrigation engineering/hydrology and in crop-water modeling/land use-planning, respectively; (2) develop a strategy to mainstream water management research into the Center's core research program; and (3) help strengthen the capacity of national organizations for conducting research on the rice-water-soil interfaces, in collaboration with IWMI and other relevant partners.

The Panel recommends that WARDA develop, in collaboration with weed scientists from advanced research institutions, a strategic vision for future research in weed management, and revisit its decision to focus almost entirely on the expected weed competitiveness of NERICAs.

Quality and relevance of science

In order to improve the priority setting process, the Panel recommends that WARDA collect relevant background information, assign appropriate weights to the constraints identified, focusing only on a few major constraints of regional interest for each rice ecosystem, and better define homogeneous target areas (e.g. through stratification of the biophysical and socio-economic environments).

The Panel recommends that WARDA allocate more time and resources to the development of concepts and methodologies, and to understanding genetic and physiological mechanisms and processes responsible for superior performance in the appropriate genetic backgrounds (*O. sativa*, *O. glaberrima*, or NERICAs, according to the situation).

In order to ensure that available scientific talent is utilized primarily for science, and in order not to compromise research quality, the Panel recommends that WARDA make every effort to achieve a reasonable balance between in-house scientific activities and external network or partnership activities that focus more on development than on research.

Social sciences

Because of research gaps in the social sciences research program (policy analysis, rainfed production economics, adoption studies), the Panel recommends that WARDA recruit a rural sociologist and fill other positions in the social sciences (production economist, policy economist) in a timelier manner.

Research support

The Panel recommends that WARDA make the necessary investments and provide funds on a regular basis to ensure communications (e-mail and internet) that meet the performance standards expected at an international research institute, both at its headquarters and outstations.

Because good statistical design and analysis is an essential component of research quality, the Panel recommends hiring as soon as possible one full-time biometrician, preferably with good experience in Genotype x Environment interaction analysis, design of on-farm field trials, and analysis of survey data coming from Participatory Varietal Selection.

Partnerships and linkages

The Panel recommends that WARDA develop a medium- and long-term strategy for a phased expansion in Central, East and southern Africa, in line with available funds, without compromising critical mass in West Africa. Moreover, the programmatic alignment of WARDA with IRRI in East and southern Africa should specify their respective roles based on their respective comparative advantages.

Because the System-Wide Initiative on HIV/AIDS (SWIHA) is not expected to contribute to WARDA's core research outputs, the Panel recommends that WARDA transfer its convening role to a partner more suited to leading the SWIHA initiative.

Adoption and impact

Because technology generation must take into account the heterogeneity of the environments and the farming populations, including the different needs of farmers, for better targeting of technologies and better adoption, the Panel recommends that WARDA, in its adoption and impact studies, involve suitable interdisciplinary teams from its research program (breeding, natural resource management, socio-economics).

Governance and management

The Panel recommends that the Program Committee augment its resources by relying on an external Board-appointed Scientific Advisory Committee (SAC) comprised of 3-4 outstanding scientists with knowledge of rice and/or other cereals from around the globe, who would provide in-depth guidance on technical quality and strategic directions of science undertaken by WARDA.

The Panel recommends that the Financial Procedures Manual (which was last issued in 2001) be updated and suitably revised, as needed, and that compliance with these procedures be ensured by the Board and Management so that the financial control environment operates as intended.

The Panel recommends that the staff and heads of Corporate Services of WARDA and IITA: a) continue a very collaborative approach to ensuring that the transfer/alignment of corporate services proceeds smoothly; b) closely monitor on a regular basis the progress made by the various Transition Task Forces, Steering Committee, and the Local Implementation Committees at Cotonou and other sites covered by the Memorandum of Agreement; and c) seek to benefit from the experience of other Centers that are aligning corporate services. Nevertheless, it cautions WARDA that in seeking efficiency gains from the alignment of corporate services, it ensures that research quality and relevance are not compromised, and that scientists continue to have access to adequate technical support during and after the alignment process.