Evaluation of the CGIAR Research Program on Global Rice Science Partnership (GRiSP)

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Acronyms

ACIAR	Australian Centre for International Agricultural Research
AfRGM	African Rice Gall Midge
AfricaRice	Africa Rice Center
ARBTF	Africa-wide Rice Breeding Task Force
ARI	Advanced Research Institute
AWD	Alternative Wetting and Drying
BCR	Benefit Cost Ratio
BLB	Bacterial leaf blight
BMP	Best Management Practice
BoT	Board of Trustees
CAAS	Chinese Academy Of Agricultural Sciences
CARD	Coalition for African Rice Development
CCAFS	Climate Change, Agriculture and Food Security CRP
CCER	Center-Commissioned External Review
CIAT	Centro Internacional de Agricultura Tropical
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CORAF	Conceil Ouest et Centre Africain pour la Recherche et le Développement Agricoles
CORIGAP	Closing Rice Yield Gaps in Asia
CORRA	Council for Partnership on Rice Research in Asia
CSISA	Cereal Systems Initiative for South Asia
CRP	CGIAR Research Program
CSO	Civil Society Organization
CURE	Consortium for Unfavorable Rice Environments
DSR	Direct Seeded Rice
ESA	Eastern and Southern Africa
FLAR	Fondo Latinoamericano para Arroz de Riego
FP	Flagship Project
GAP	Good Agriculture Practice
GM	Genetically modified
GRiSP	Global Rice Science Partnership
GRiSS	Global Rice Science Scholarship
GWAS	Genome-wide Association Studies

GxExM	Genotype, Environment and Management
HRDC	Hybrid Rice Research Consortia
IAU	Internal Audit Unit
IDO	Intermediate Development Outcome
IEA	Independent Evaluation Arrangement of CGIAR
IF	Impact Factor
IITA	International Institute of Tropical Agriculture
IRD	Institut de recherche pour le développement
IRIC	International Rice Informatics Consortium
IRRC	Irrigated Rice Research Consortium
IRRI	International Rice Research Institute
ISPC	Independent Science and Partnership Council
JIRCAS	Japan International Research Center for Agricultural Sciences
M&E	Monitoring and Evaluation
MAB	Marker-Assisted Breeding
MAIZE	CRP on Maize
MET	Multi-environment Trials
NARS	National Agricultural Research System
NERICA	New Rice for Africa
NGOs	Non-Governmental Organizations
NIAES	National Institute for Agro-Environmental Sciences
NRDS	National Rice Development Strategies
NPV	Net Present Value
PhilRice	Philippine Rice Research Institute
PIM	Policies, Institutions and Markets CRP
PIPA	Participatory Impact Pathways Analysis
PL	Product Line
PMU	Programme Management Unit
PPMT	Program Planning and Management Team
PRAY	Phenomics of Rice Adaptation and Yield
PVS	Participatory Variety Selection
RAFS	Rice AgriFood Systems CRP
RCT	Randomized Control Trial
RGA	Rapid Generation Advance
RYMV	Rice Yellow Mottle Virus

QTL	Quantitative Traits Locus
SARD-SC	Support to Agricultural Research for Development of Strategic Crops in Africa
SDG	Sustainable Development Goals
SSD	Sawah System Development
SSNM	Site Specific Nutrient Management
SLO	System-Level Outcome
SRF	Strategy and Results Framework
SRP	Sustainable Rice Platform
STRASA	Stress Tolerant Rice for poor farmers in Africa and South Asia
STRVs	Stress-tolerant rice varieties
ToC	Theory of Change
TOR	Terms of Reference
W1/W2	Window 1 or Window 2 funding
W3	Window 3 funding
WHEAT	CRP on wheat

Executive Summary

Background and context

The Global Rice Science Partnership (GRiSP) brings together three CGIAR centers—the International Rice Research Institute (IRRI), the Africa Rice Center (AfricaRice) and Centro Internacional de Agricultura Tropical (CIAT)—and three non-CGIAR Institutions—Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Japan International Research Center for Agricultural Sciences (JIRCAS) and Institut de recherche pour le développement (IRD)—as core partners. Together with about 900 other partners worldwide GRiSP engages in impact-oriented research designed to contribute the objectives of the CGIAR. GRiSP began in 2011 with approval for five years at a budget of USD 593 M--the largest of the 15 CGIAR Research Programs (CRP).

Rice as the world's most important food crop is critical to global food security. About three billion people, including many of the world's poorest, consume rice as their staple food and hundreds of millions of poor people depend on rice farming for their livelihood many of them in high-risk rainfed environments. There are major constraints to meeting future rice production needs including loss of land, labor and water resources in Asia to other crops and nonfarm uses, and slow genetic yield gains. Rice consumption in Africa is rising faster than in other regions, and major investments are needed to develop land and water resources and above all sustainably intensify existing rice area. In all regions, including Latin America, climate change will impact rice production systems that are in turn a cause of climate change and environmental degradation more generally.

GRiSP formulated three objectives—to increase rice productivity, foster sustainable rice-based cropping systems, and improve efficiency and equity of the rice sector. Through 2015, these objectives were implemented through six Themes:

1. Harnessing genetic diversity to chart new productivity, quality, and health horizons.
2. Accelerating the development, delivery, and adoption of improved rice varieties.
3. Ecological and sustainable management of rice-based production systems.
4. Extracting more value from rice harvests through improved quality, processing, market systems and new products.
5. Technology evaluations, targeting and policy options for enhanced Impact.
6. Supporting the growth of the global rice sector.

Within the Themes there are 26 Product Lines for generating 94 products. The six Themes were further restructured into five flagships in the approved 2016 extension proposal, including one on value chains. GRiSP also funded "New Frontier" research through competitive calls for exploratory research in promising areas, a scholarship program to build a new generation of rice scientists, and a gender strategy and its implementation.

Purpose and scope of the evaluation

The principal purpose of this evaluation is to enhance the contribution that GRiSP makes to reaching CGIAR goals, in particular food security and poverty reduction. The evaluation is aimed to inform

decision-making and planning by GRiSP management, CRP sponsors, partners and other stakeholders with respect to GRiSP's performance and potential options for the future. This evaluation is one of ten CRP evaluations commissioned by the Independent Evaluation Arrangement of the CGIAR (IEA) at the request of the CGIAR Fund Council to provide evaluative information for the preparation and approval of a second around of CRP proposals for 2017-2020.

This evaluation looks at the extent to which GRiSP, within its mandate, along with its partners and donors are responding to the key aspirations underlying the CGIAR reform related to vision and focus, delivery orientation, synergy through efficient and effective partnerships, and accountability. The evaluation looks at both programmatic and organizational aspects of the CRP in relation to six main criteria: relevance, quality of science, likely effectiveness, efficiency (related to organizational arrangements), impact and sustainability.

The evaluation was designed around seven overarching questions, which complement and amplify the set of criteria-specific evaluation issues elaborated below.

a) What is the value added of GRiSP in facilitating synergies that enhance the global benefits from CGIAR rice research to poor farmers and consumers?

b) Is GRiSP structure conducive to engaging advanced research institutes (ARIs) to harness their knowledge and innovations to enhance the effectiveness of global rice research?

c) Are the partnerships with national innovation systems structured to enhance the capacity of those systems for sustained impact?

d) Has GRiSP been successful in implementing an outcome and impact oriented culture and approach to research, while at the same time investing in long-term strategic science?

e) Does the GRiSP partnership elevate the quality of science among its partners while maintaining the relevance of science for GRiSP objectives?

f) In the current complex funding environment, has GRiSP been able to manage multiple sources of funding to assure strategic coherence around highest priority areas of research?

g) To what extent do the governance and management structures and practices of GRiSP contribute to or impede the achievement of program coherence and effectiveness?

Evaluation approach and methods

The evaluation used a cross-scale approach that generated evidence from the application of a number of methods:

Case studies: The Team selected 12 case studies based on specific product lines for in depth review of specific research areas. Each case study reviewed evidence and information from multiple sources such as project review, expert testimonies, country visits, and publications. The selection criteria included: (i) their relevance for the target recommendation domains (in terms of production systems and beneficiary groups); (ii) their size in terms of budget allocation; (iii) their ability to explore linkages across Themes and across Regions; and (iv) their ability to explore linkages across the core partners

Interviews: The Team conducted hundreds of interviews during on-site visits and about 70 remote interviews with the aim of assessing the views of a representative group of stakeholders. The interviewee categories included the full range of stakeholders from GRiSP governance, management, and scientists, a wide range of partners from research to delivery, key donors and peer scientists.

Desk reviews: The Team reviewed a wide range of CGIAR and GRiSP documents such as the proposal and its extension, annual reports, bilateral project reports, and external reviews commissioned by the centers or donors, as well as internal reports such as the Annual Program of Work and Budget, minutes of meetings, and progress reports to donors of bilateral projects.

Portfolio analysis: The Portfolios of all participating centers were analysed regarding distribution of grants across Themes and Product lines, the distribution of funding across Themes and Product Lines, and annual budgets and expenditures.

Researcher survey: The Evaluation Team survey was sent out to 204 GRiSP researchers who contributed to research mapped to GRiSP and received responses from 112 researchers (55% response rate). The survey covered aspects of research relevance, quality of science, likely effectiveness, management effectiveness and cross-cutting issues (gender, partnerships and capacity strengthening).

Field visits: Field visits were made to 10 national programmes and to IRRI, AfricaRice, CIAT, CIRAD and IRD headquarters to meet with scientists, managers, partners and other stakeholders. Members of the Team also attended two meetings of the Oversight Committee of GRiSP.

Main findings on relevance, quality of science and effectiveness

Relevance: The Team assessed that the GRiSP portfolio is highly relevant to the CGIAR's System-Level Outcomes (SLOs) and that the GRiSP objectives and portfolio address Intermediate Development Outcomes (IDOs) that map well to the SLOs. The Team concluded that GRiSP is poised to make major contributions to the SLOs given the strength of its portfolio, the global importance of rice, and recent technological breakthroughs in less favored rice environments.

Relevance can be further enhanced by a stronger engagement in foresight and analysis given the fast changing agro-ecological and socio-economic environment in many rice-producing countries. A major challenge will be to address trade-offs in benefits on the producer and consumer sides with respect to achieving the new Sustainable Development Goals (SDGs) where countries are rapidly urbanizing.

Donor emphasis on short-term results and impacts has sometimes taken GRiSP very downstream into technology delivery and extension where it does not have a comparative advantage. At the same time, there has been underinvestment in exploratory type research for long-term impacts including pest ecology and disease epidemiology, value chains, and competitiveness.

Finally, the structure of GRiSP largely along disciplinary lines has sometimes been at the expense of interdisciplinary research. At the site or hub level, the Team sees considerable scope to strengthen demand perspectives through participatory approaches and carefully designed diagnostic and adaptive research involving disciplinary skills from both the natural and social sciences.

Quality of science: Overall, the quality of science in GRiSP is good although uneven across centers and disciplines. GRISP has published major papers that are already highly cited. This was achieved with a sound management of research, a strong involvement of most researchers in the global scientific community and good partnerships with ARI for expanding the scientific input. The Evaluation Team nevertheless notes that there are too many publications in minor venues, with no or very low IFs that puts the quality of the peer review mechanisms in doubt. Also AfricaRice needs to continue to push for improving its performance in quality of science through appropriate incentives and support, continuation of the center-managed external reviews, and deeper integration and collaboration with GRiSP partners and with ARIs. Finally, although there is some outstanding work in social science, there are missed opportunities for highly relevant and innovative interdisciplinary research for which stronger partnerships with ARIs are needed to build capacity.

Effectiveness: GRiSP has made a strong start toward establishing an effective global rice science partnership. Much has been achieved in building collaboration among the core partners but there is also a great deal of potential to further deepen collaboration through research on globally important challenges in rice. The most urgent task is to integrate the IRRI and AfricaRice programs around a common rice science strategy in Eastern and Southern Africa.

GRiSP has also strengthened the results orientation of its research and the impact culture of its scientists. It has developed appropriate theories of change although more work is needed for scaling up site specific management technologies and value chain research. It is generally on track toward achieving planned outputs and outcomes. Progress in the GRiSP breeding programs needs to be closely monitored and in the case of Africa, stronger breeding programs are needed to address the many different rice environments and complex stresses in the region. Research in other Themes is necessarily more site specific and the strategy for local adaptation and scaling out through partnership needs further development. Work at the value chain level has been limited to date but is now mainstreamed into the GRiSP strategic framework. Finally, GRiSP needs to strengthen upstream or exploratory research to assure a future technological pipeline in a rapidly changing scientific, climatic and economic environment.

Cross-cutting issues: partnership, gender and capacity building

Partnerships with ARIs and other CRPs. GRiSP centers have strong partnerships with ARIs as evidenced by a large number and increasing trend in the number of co-authored publications with ARIs, although it is too soon to discern the influence of GRiSP itself on this trend. The advance in rice genomics represents a unique window of opportunity for GRiSP to engage a large and growing community of rice researchers in ARIs. This is starting to happen with new GRiSP initiatives such as the International Rice Informatics Consortium (IRIC).

GRiSP also has many partnerships with other CRPs and centers. However, there is potential for much better collaboration across CRPs, especially between GRiSP and the Policies, Institutions and Markets CRP (PIM).

Partnerships with national programs. To review the many partnerships with national innovations systems, the Team developed a typology of models for collaboration based on type of membership

(public, private etc.), the size and sources of funding (especially member contributions) and the governance structure (decisions on the work program and fund allocation). While partnerships with national systems were generally strong and stakeholders provided positive feedback, GRiSP could do more to rationalize the choice of model, evaluate them and share experiences across regions. In particular, the Team questions the decision to take on very large bilateral projects for technology delivery without a better defined long-term strategy for engaging and building capacity of national partners to ensure sustainability.

Gender. GRiSP has articulated a gender strategy with specific goals and targets in all its Themes and organized a range of activities to sensitize and train scientists and their partners in gender analysis. The Team concludes that GRiSP has been much more successful in mainstreaming gender downstream in delivery activities than in incorporating gender as an integral part of research planning and technology design. As such gender is perceived more as an equity objective than as a critical element for improving research effectiveness. A weakness in research on gender in rapidly evolving rice farming systems is a major limitation to better mainstreaming gender in research planning.

Capacity development. In 2014, GRiSP supported post-graduate degree training for an impressive 436 scholars, of which 186 were female. In addition, it has provided short term training for thousands of scientists and other professional and tens of thousands of farmers. The evaluation concludes that while GRiSP overall is strong on training at many levels, there is no coherent strategy that is premised on a broader objective of institutional capacity development to achieve sustainable outcomes. The Team advocates a more strategic approach to institutional capacity development to guide its investments in human resources capacity development.

Impacts

Legacy research of GRiSP has produced very large and wide scale economic benefits as well as notable impact on poverty reduction and food security, especially through genetic improvement. Although the impact studies reviewed have big gaps, notably India and China, the benefits realized from GRiSP legacy research are in the tens of billions of dollars in Asia, and in the hundreds of millions of dollars in Africa and in Latin America. The largest documented impacts continue to be in favored areas but preliminary evidence provided by early adoption and impact studies of stress tolerant varieties in South Asia and New Rice for Africa (NERICAs) in Africa suggests that this situation is changing. Future impacts of GRiSP investments could be realized on a large scale in less favored areas. Evidence of impacts on investment in other thematic research areas, especially crop management research, is more fragmented and localized. GRiSP still needs to develop a comprehensive system for assessing the global impacts of its investment using state-of-art tools.

Governance and management

The Team considers that GRiSP is well governed and managed in a complex environment. In most cases, application of the principle of subsidiarity to decentralize decision making and implementation to the centers is working well for reducing duplication and transaction costs. Governance practices could be improved at the level of the Oversight Committee by better communication with stakeholders about the processes for stakeholder input to strategic priority setting for GRiSP, and by

the use of coordinated external evaluations of specific research Themes across GRiSP. Management structures could be improved by distributing leadership across GRiSP according to expertise, integrating the monitoring, learning and evaluation systems across GRiSP, and increased allocation of more W1/W2 resources to strategic research through competitive processes.

Given the complexity of funding sources and the unreliability of W1/W2 funds, GRiSP has managed well to implement its original portfolio. The most significant threat to GRiSP sustainability is the decline in W1/W2 funding and the unreliability of its delivery.

Value added of GRiSP

Overall GRiSP has succeeded in significantly increasing the interaction and synergies between the six core partners. GRiSP has provided a global framework for setting a shared agenda for rice research, thinking about impact pathways, and developing collaborative research on globally important challenges for the rice sector. Under GRiSP, sharing of germplasm and knowledge and interaction among scientists across the three CGIAR centers has sharply increased especially in gene discovery and other exploratory research. Interaction of centers with the core non-CGIAR partners has also become more frequent and systematic. The New Frontier projects financed competitively have fostered strong collaboration across partners.

Even so, GRiSP is a work in progress and there is much potential to deepen collaboration and integration of research around globally important research topics. Evidence of increased research collaboration in the form of publications co-authored across the partners has yet to emerge. In Eastern and Southern Africa, the lack of collaboration and integration of AfricaRice and IRRI is a big missed opportunity for GRiSP that needs to be urgently rectified so that this region becomes a showcase for GRiSP collaboration.

The future

This review finds that GRiSP has made a strong start that promises to produce major impacts for the CGIAR objectives of poverty reduction, sustainability, and food security and nutrition. However, GRiSP will require many years to develop a truly integrative and collaborative global rice science partnership. This evaluation has recommended several areas where GRiSP could strengthen its relevance, effectiveness, and partnership to better realize its ambition. The Team notes that there is considerable congruency between several of our recommendations and changes to GRiSP recorded in the second round CRP pre-proposal on Rice AgriFood Systems submitted to the Fund Council in August, 2015.

GRiSP has articulated a wider ambition of a global science partnership that would be broader than the CGIAR-centered activities that are the core of the current GRiSP. Given the surge in rice science in ARIs and the feedback from strong National Agricultural Research Systems (NARSs), such an aspiration is indeed appropriate. However, the Team cautions on moving too fast, especially in a highly uncertain budget environment. The core partnership structure is working well but going forward, GRiSP should review the role of non-CGIAR core partners and the potential to include others, especially from advanced NARSs. A broader global partnership should be framed around a few high priority global challenges, perhaps scaling up successful New Frontier projects.

Recommendations

The Evaluation Team makes a total of 14 recommendations presented below by the main evaluation criteria.

Relevance

Recommendation 1: Taking into account local institutional capacity for adaptive research, GRiSP should work with national partners to ensure that interdisciplinary research on the social, economic and natural context is used to tailor crop and resource management technologies more precisely to the needs of intended beneficiaries.

Quality of science

Recommendation 2: GRiSP management should encourage and incentivize stronger research collaboration among GRiSP centers and their partners in ARIs for improving the overall quality of the scientific output through jointly authored, high quality publications.

Effectiveness

Recommendation 3: GRiSP should articulate a strategy for scaling up and scaling out beyond its immediate beneficiaries, by researching methods and business models for effective and equitable delivery, especially for management and post-harvest technologies, coupled with capacity development of relevant partners.

Recommendation 4: GRiSP should without delay deliver a single integrated rice research program in Eastern & Southern Africa, coordinated by AfricaRice and drawing on the relative strengths of *both* AfricaRice and IRRI, in order to improve efficiency and complementarities, and enhance the image of GRiSP among its stakeholders in the region. This recommendation should be implemented prior to the commencement of the second phase of GRiSP (the CRP on rice agrifood systems).

Recommendation 5: AfricaRice should modernize and intensify its rice breeding program for feeding elite lines to the Africa-wide Rice Breeding Task Force (ARBTF), for all major rice ecosystems in Africa. GRiSP core partners, especially IRRI, should give support to the African program, developing traits and elite populations targeting African needs.

Recommendation 6: Opportunities, incentives and modalities should be created to increase interdisciplinary research, in order to deliver integrated solutions consistent with the IDOs on critical problems of major rice production systems especially at the hubs and sites where GRiSP works.

Cross-cutting issues

Recommendation 7: The rapid acceleration of rice research worldwide over the past 15 years is an opportunity for GRISP to develop new partnerships with ARIs. GRISP should enrich its portfolio of new frontier and discovery research projects in partnership with ARIs with the objective of exploring new concepts and tools to achieve its goals.

Recommendation 8: In order to achieve sustainable outcomes from investments in institutional and human capacity development, GRiSP should support participating countries to develop long-term capacity building strategies and tailor GRiSP capacity building support to the priorities of those strategies.

Recommendation 9: GRiSP should do more in-depth analysis to understand opportunities and constraints of women in rice farming and value chains in order to better address the effectiveness and equity impacts of its research and technology delivery.

Impacts

Recommendation 10: GRiSP with its national partners should institutionalize a systematic process of assessing its equity, nutrition and environmental impacts at a global level, especially for its germplasm, employing the latest tools and methods to achieve credible standards of rigor at reasonable costs.

Governance and management

Recommendation 11: The Oversight Committee should define its processes of consultation for establishing global strategic priorities in rice research, and communicate this process widely to its stakeholders.

Recommendation 12: GRiSP level external reviews of particular areas of research should be commissioned by the Oversight Committee in consultation with the Board Program Committees and managed by the Programme Management Unit (PMU).

Recommendation 13: GRiSP should review and clarify the roles and expectations of its non-CGIAR partners (JIRCAS, IRD and CIRAD) in governance, management and research implementation. This review should also consider the desirability of expanding core partnerships for specific Themes, the criteria for doing so, and their role in management if included.

Recommendation 14: The Consortium (W1) and the Fund Council (W2) should provide expanded and reliable core funding to GRiSP in order to take full advantage of the innovative scientific partnerships available for collaborative research, as envisaged in the Strategy and Results Framework (SRF).

1. Introduction

1.1 Purpose and audience

GRiSP brings together three CGIAR centers—IRRI, Africa AfricaRice and CIAT—and three non-CGIAR Institutions—CIRAD, JIRCAS and IRD—as core partners. Together with around other 900 partners world-wide GRiSP engages in impact-oriented research designed to contribute to the objectives of the CGIAR. GRiSP began in 2011 with approval for five years at a budget of USD 593 M—the largest of the 15 CRPs.

The principal purpose of this evaluation is to enhance the contribution that GRiSP makes to reaching the CGIAR's goals, in particular food security and poverty reduction. The evaluation aims to inform decision-making and planning by GRiSP management, CRP sponsors, partners and other stakeholders with respect to GRiSP's performance and options for the future. The evaluation is one of ten CRP evaluations commissioned by the IEA at the request of the CGIAR Fund Council to provide evaluative information for the preparation and approval of the second around of CRP proposals for 2017-2020.

This evaluation looks at the extent to which GRiSP, within its mandate, along with its partners and donors are responding to the key aspirations underlying the CGIAR reform related to vision and focus, delivery orientation, synergy through efficient and effective partnerships, and accountability. The GRiSP evaluation looks at both programmatic and organizational aspects of the CRP and cover six main criteria as defined in the Terms of Reference (TOR) [1]: relevance, quality of science, likely effectiveness, efficiency (related to organizational arrangements), impact and sustainability. The Evaluation Team's short bios are presented in Annex A (Volume 2).

1.2 The evolving CGIAR context

Since the start of GRiSP and during the course of this evaluation, the CGIAR approved extensions to all 15 CRPs for 2015-16 and adopted a new SRF[2] to replace the original from 2010. The new SRF identifies CGIAR objectives at three levels: Intermediate Development Outcomes (IDOs) at sub-level for the CRPs and for the CRP portfolio, and SLOs.[3] The CRPs have been developing their impact pathways and theories of change (ToC) that link CRP activities and outputs to the IDOs that are, in turn, link to the SLOs that represent the CGIAR's high level goals. The CRPs have also been defining quantitative targets and measurable indicators for progress towards the IDOs and SLOs.

[1] http://iea.cgiar.org/sites/default/files/GRiSP%20evaluation%20Final%20TOR-web.pdf

[2] CGIAR Strategy and Results Framework for 2016-2025. May 2015. https://library.cgiar.org/bitstream/handle/10947/3865/CGIAR%20Strategy%20and%20Results%20Framework.pdf?sequence=1

[3] The three SLOs in are: Reduced poverty; Improved food and nutrition security for health; and Improved natural resource systems and ecosystems services.

A new CRP cycle begins in 2017. In May 2015, the CGIAR agreed on a new CRP portfolio and issued a call for CRP pre-proposals for the second funding cycle. In August 2015, GRiSP put forward a pre-proposal for a Rice Agri-Food Systems CRP.

The funding sources available to the CRPs are shown in **Box 1-1**. During the first phase of GRiSP, the Widows 1 and 2 (W1/2) funding decreased relative to other forms of funding and declined in real terms. W1/2 funding provides the greatest flexibility to the CRP managers to strategically allocate funds to meet IDOs and SLOs.

Box 1-1 Major sources of funding in the CGIAR system

To maximize coordination and harmonization of funding, donors to CGIAR are strongly encouraged to channel their resources through the CGIAR Fund. Donors to the Fund may designate their contributions to one or more of three funding "windows":

- Contributions to Window 1 (W1) are the least restricted, leaving to the Fund Council how these funds are allocated to CGIAR Research Programs, used to pay system costs or otherwise applied to achieving the CGIAR mission.
- Contributions to Window 2 (W2) are designated by Fund donors to specific CGIAR Research Programs.
- Contributions to Window 3 (W3) are allocated by Fund donors to specific CGIAR centers.

Participating centers also mobilize financial resources for specific activities directly from donors and negotiate agreements with their respective donors for the use of these resources

Source: http://www.cgiar.org/who-we-are/cgiar-fund/

1.3 Evaluation questions

During the inception phase the Evaluation Team articulated seven overarching questions, which complement and amplify the set of criteria-specific evaluation issues elaborated in the evaluation Inception Report.[4]

a) What is the value added of GRiSP in facilitating synergies that enhance the global benefits from CGIAR rice research to poor farmers and consumers?

b) Is GRiSP structure conducive to engaging ARIs to harness their knowledge and innovations to enhance the effectiveness of global rice research?[5]

c) Are the partnerships with national innovation systems structured to enhance the capacity of those systems for sustained impact?

d) Has GRiSP been successful in implementing an outcome and impact oriented culture and approach to research, while at the same time investing in long-term strategic science?

[4] http://www.iea.cgiar.org/sites/default/files/Inception%20Report%20Global%20Rice%20Research%20Partnership_0.pdf

[5] GRiSP engages research organizations in both developing and developed countries that have high level of research competence, resources and mandate for strategic research related to rice, which can be complementary and synergistic with the CGIAR.

e) Does the GRiSP partnership elevate the quality of science among its partners while maintaining the relevance for GRiSP objectives?

f) In the current complex funding environment, has GRiSP been able to manage multiple sources of funding to assure strategic coherence around highest priority areas of research?

g) To what extent do the governance and management structures and practices of GRiSP contribute to or impede the achievement of program coherence and effectiveness?

1.4 Evaluation criteria

As part of programmatic performance, the evaluation looked at the following evaluation criteria:

Relevance: The evaluation assessed the extent to which the objectives and design of GRiSP are consistent with current global and national priorities, as well as those of it's intended beneficiaries, partners and donors. It also reviewed the extent to which the CRP is consistent with the CGIAR SLOs and whether program components and activities are consistent with the CRP's objectives at the level of its IDOs. An important part of relevance was an assessment of the comparative advantage of the program and the role of other providers in the context of rapid changes in global science.

Quality of science: The evaluation reviewed several dimensions of quality of science including the make-up of the research teams and partnerships, research design, research management, quality assurance and research outputs. It conducted bibliometric studies on the quantity and quality of publications as measured by citation and the IF of journal outlets, and the scientific record of research project leaders as measured by their H-index. It also reviewed a random sample of 85 publications for rigor of methods, comprehensiveness of the narrative, novelty and appropriateness of the publication venue. The quality of breeding processes and outputs were assessed as part of effectiveness. The evaluation also reviewed the processes and incentives in place for ensuring high quality science across program components and partners.

Likely effectiveness: Effectiveness was assessed primarily from the point of view of likely effectiveness of the current program, rather than past impact. The evaluation reviewed the plausibility of the ToCs underpinning the impact pathways (both generic and specific) and the extent that risks and constraints influencing out-scaling, outcomes and impacts are being addressed in research design, partnerships and capacity building. The synergies realized among the core partners through GRiSP were also analysed. Finally progress towards milestones and outputs across the research portfolio was reviewed as well as the extent to which the Monitoring and Evaluation (M&E) system is used by management to adjust research plans and impact pathway designs, including feedback from onfarm and value chain research.

Impact: As part of the summative component of the evaluation the extent to which past research has led to positive outcomes and impacts was assessed based largely on studies at center level on adoption, outcomes and impact. To the extent possible, the evaluation also assessed emerging results and outcomes of GRiSP.

Partnerships: The evaluation reviewed three types of partnerships—with ARIs, with other CRPs and CGIAR centers, and with national innovations systems. Issues considered issues included coordination, decision-making, joint ownership of results, transaction costs, equity and transparency.

Gender: The evaluation assessed the adequacy and implementation of the GRiSP gender strategy including measures to enhance the relevance of research to women as well as gender-dependent factors that affect the acceptance and uptake of results, the possible unintended consequences affecting women, and adoption outcomes. The depth and quality of research on gender in rice systems was reviewed as an essential input for gender-sensitve GRiSP research design.

Capacity development: The evaluation analyzed how capacity development (CapDev) is prioritized in order to address partners' needs and considering GRiSP's comparative advantage and the incorporation of CapDev into research activities for enhancing the relevance and likely uptake of research results. CapDev is seen as closely linked to the review of partnerships and also incorporated into the assessment of relevance and likely effectiveness.

Governance and management: The evaluation built on the CGIAR's 2014 "Review of CGIAR Research Programs' Governance and Management" focusing on: (i) management oversight; (ii) stakeholder participation, (iii) risk management, (iv) conflict management and (v) audit and evaluation. Special attention was given to management of different funding sources, especially W1/W2 funds and the implications of the funding short falls in 2014 and 2015. The methods used for monitoring and documenting GRiSP results were assessed, including the aspects of program design and implementation.

1.5 Evaluation methods

The evaluation used a cross-scale approach, which includes multiple methods discussed below.

Case studies: The purpose of the case studies was to provide an in-depth review of a subset of research according to the key criteria of the review. The Evaluation Team selected 11 case studies based on specific product lines (PL) and one case study on Theme 1 (Harnessing genetic diversity). Each case study reviewed evidence and information from multiple sources such as project review, expert testimonies, country visits, and publications. The first set of case studies focused on 11 PLs that have particular relevance to delivery of research results and impact on the two main rice production systems; namely favourable, mostly irrigated, and unfavourable, mostly rainfed production systems. In selecting the PLs for this set of case studies the criteria included: (i) their relevance for the target recommendation domains (in terms of production systems and beneficiary groups); (ii) their size in terms of budget allocation; (iii) their ability to best explore linkages across Themes and across Regions; and (iv) their ability to explore linkages across the core partners. The case study on Theme 1 research took a networking perspective looking at linkages among the core GRiSP partners and with ARIs.

Interviews: The Evaluation Team conducted interviews, both on-site and over 50 remotely, with the aim of interviewing a representative group of stakeholders across relevant categories, and involving both GRiSP partners and other stakeholders. The interviewee categories included the full range of

stakeholders from GRiSP governance, management, and scientists, a wide range of partners from research to delivery, key donors and peer scientists. A full list of interviewees is given in Annex C (Volume 2). The interviews followed a general guideline with a check-list of core issues specifically designed for different categories of interviewees.

Document review: The Team reviewed a wide range of CGIAR and GRiSP documents such as the proposal, its extension and the Independent Science and Partnership Council (ISPC) commentaries on these, annual reports, bilateral project reports, and external reviews commissioned by the centers or donors, including the audit by the CGIAR's Independent Audit Unit. The review also included internal reports such as the Annual Program of Work and Bud get, minutes of meetings, and progress reports to donors of bilateral projects. The Team's assessment of past impact was largely based on a comprehensive impact narrative prepared by GRiSP, backed up by evidence from peer-reviewed studies.

Portfolio analysis: The portfolios of all participating centers were analysed regarding distribution of grants across Themes and PLs, the distribution of W1/2 funding across Themes and PLs, and annual budgets and expenditures.

Researcher survey: The Evaluation Team surveyed 204 IRRI, AfricaRice and CIAT researchers who contributed to research mapped to GRiSP. In total 112 scientists responded (55% response rate). The survey covered research and programme management including aspects of relevance, quality of science and likely effectiveness, management effectiveness and cross-cutting issues (gender, partnerships and capacity strengthening). Results are given in Annex D (Volume 2).

Field visits: Field visits were made to 10 countries and to IRRI, AfricaRice, CIAT, CIRAD and IRD headquarters to meet with scientists, managers, partners and other stakeholders to provide input to the case studies, review of quality of science. The Team itinerary is given in Annex B (Volume 2).

Analysis of evidence. The case studies were a main method to accumulate information on a number of the evaluation criteria, particularly aspects of relevance and likely effectiveness. Individual case study reports involve collation of evidence from multiple sources, giving particular emphasis to document review, interviews with key informants knowledgeable of the line of work, many of them at sites visited, and triangulation with observations made by Team members. Criteria and evaluation questions that draw less on the case studies, such as quality of science and aspects related to governance and management were also addressed using multiple sources of evidence, including quantitative analysis for the quality of science aspects, and Team discussion.

1.6 Main limitations of the evaluation

Due to the large number—and institutional and geographic spread—of partnerships in GRiSP, the Evaluation Team had to be selective in regard to the activities reviewed, stakeholders contacted, and sites visited. This need for focus necessarily means that some components of the Program were not assessed in depth. The evaluation was also conducted at a time of considerable uncertainty with respect to the future structure of the CGIAR, the CRP portfolio and the availability of funding. Finally,

GRiSP has been in operation only four years; a time period that is insufficient to fully see the results of the research program, particularly regarding development outcomes from GRiSP investments. Much of the evaluation was 'formative' by assessing progress and likely effectiveness of research in the pipeline. The 'summative' part of the evaluation necessarily drew on outcomes and impacts of research completed prior to GRiSP. Finally, the Team had difficulties in getting systematic information from each CGIAR center regarding mapping of bilateral project to PLs and project funding and allocation of W1/2 funds to PLs and activities at center level.

2. Description of GRiSP

2.1 Context—rice in the global food system

Rice as the world's most important food crop is critical to global food security. Some three billion people in the world consume rice as an important staple, and 650 million of them are estimated to be extremely poor (less than USD 1.25 per day) (GRiSP proposal). Hundreds of millions of poor people depend on rice farming for their livelihood many of them in high-risk rainfed environments. Although there is some debate about the future supply-demand dynamics of rice in Asia, it is likely that over 100 Mt of additional rice will be needed by 2040 (Pandey et al., 2010). With rising incomes and urbanization, rice consumption is growing especially rapidly in Africa where nearly 40% of rice is imported. Rapidly urbanizing consumers everywhere are demanding higher quality rice, requiring upgrading of a range of activities along the value chain.

On the supply side, there are major constraints to meeting future production needs including loss of land, labour and water resources in Asia to other crops and nonfarm uses, and slow genetic yield gains. These constraints are less acute in Africa and Latin America but major investments are needed to develop land and water resources there. In all regions, climate change will impact rice production systems and rice cultivation in turn is a cause of climate change and environmental degradation more generally.

These challenges suggest that global investment in rice science will continue to be critical to push out the yield frontier, promote sustainable intensification, and upgrade value chains.

2.2 Program objectives and structure

The design of GRiSP predates the CGIAR reform process responding to the need to increase efficiency and coordination in rice research in the CGIAR. Discussion of a global partnership on rice science across the three CGIAR centers dates to 2007 and accelerated under the CGIAR reform process. GRiSP was approved by the Fund Council for five years (2011-15) and an extension for 2016 has also been approved. Given the extent of ongoing bilateral grants, 80% of the portfolio proposed by GRiSP comprised 'legacy research' and only 20% of funding went toward new priorities that were identified during the CRP development process. GRiSP formulated three objectives:

Objective 1: Increase rice productivity and value for the poor in the context of a changing climate through accelerated demand-driven development of improved varieties and other technologies along the value chain (addressed through Themes 1, 2, 3, 4, and 6).

Objective 2: Foster more sustainable rice-based production systems that use natural resources more efficiently, are adapted to climate change and are ecologically resilient, and have reduced environmental externalities (addressed through Themes 3, 4, and 6).

Objective 3: Improve the efficiency and equity of the rice sector through better and more accessible information, improved agricultural development and research policies, and strengthened delivery mechanisms (addressed through Themes 5 and 6).

Through 2015, these objectives were implemented through six Themes shown in Table 2-1. Within the Themes there are 26 PLs for generating 94 products. Using W1/2 funds, GRiSP funds "New Frontier" research through competitive calls for exploratory research in promising areas. The six Themes were further restructured into five flagships in the approved 2016 extension proposal as in Table 2-1.

Table 2-1 Restructuring of GRiSP for the 2016 Extension Proposal

GRiSP Themes, 2011-15	GRiSP Flagships 2016 Extension
1. Harnessing genetic diversity to chart new productivity, quality, and health horizons.	2. Harnessing genetic diversity and development of genomics tools
2. Accelerating the development, delivery, and adoption of improved rice varieties	3. Accelerated development of new varieties
3. Ecological and sustainable management of rice-based production systems.	4. Sustainable intensification along the value chain (combines Themes 4 and 5)
4. Extracting more value from rice harvests through improved quality, processing, market systems and new products	
5. Technology evaluations, targeting and policy options for enhanced Impact.	1. Technology targeting, evaluation, and prioritization along the value chain
6. Supporting the growth of the global rice sector	5. Catalyzing scaling out and capacity building

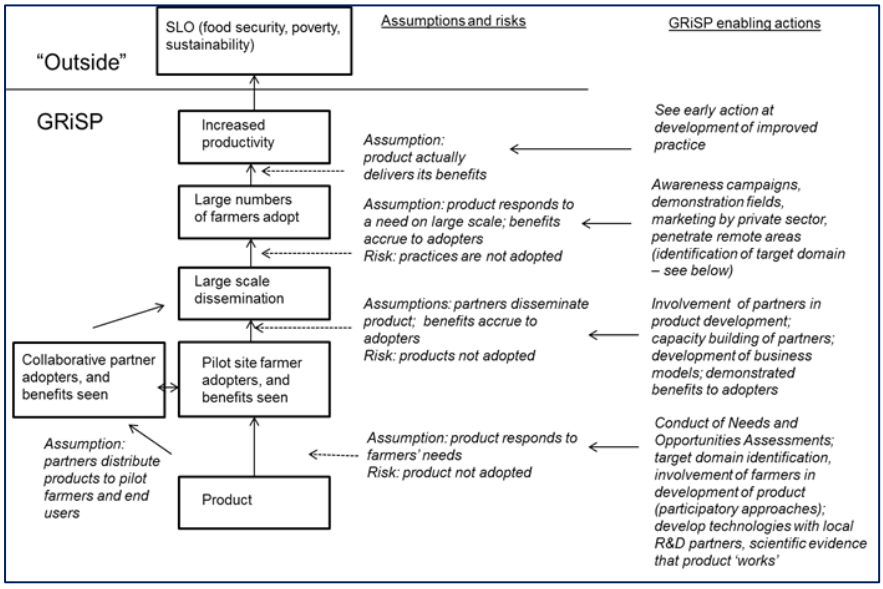
GRiSP's first gender strategy from 2010 was revised and approved in 2013. A specific ToC was developed for the "engendered" impact pathways linked to the SLOs. GRiSP also considers capacity building as an important outcome of its investments. One specific activity to train a new generation of scientists was funded through GRiSP scholarships (GRISS) (W1/2 activity).

2.3 IDOs, impact pathways and theory of change

At the time of GRiSP approval, the concept of IDOs had not been made operational, and GRiSP had developed an impact pathway from research to short-term, mid-term, and long-term outcomes, and

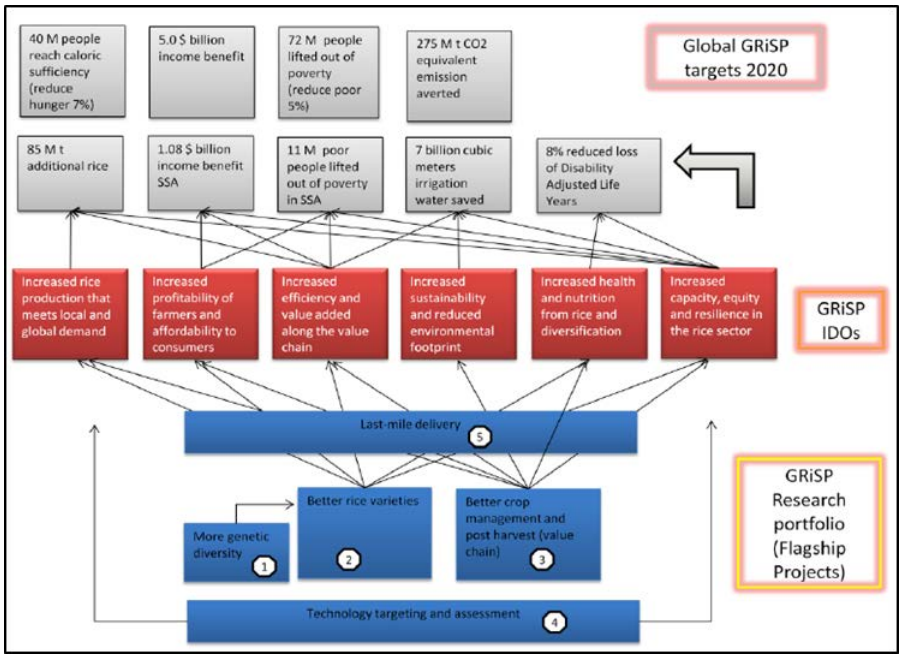
to intermediate and ultimate program impacts. When new terminology and concepts of ToCs were introduced at CGIAR level in 2013, GRiSP re-conceptualized its impact pathways through an evolving framework of IDOs. The most up-to-date thinking is captured in the proposal for the 2016 extension period, which contains a refined ToC with specific risks/assumptions and associated enabling actions the program needs to undertake—for GRiSP as a whole (Figure 2- 1), as well as for each of its Themes/Flagship projects (FPs). In this ToC, the impact pathway assumes a hierarchical order for the FPs from small to expanding scale. Each of the five FPs contributes to seven IDOs with global targets for each IDO for 2020 and 2035 based on *ex-ante* impact modeling (Figure 2- 2).

Figure 2- 1 From the larger ToC of GRiSP as a whole, an impact pathway leading to the IDO "increased productivity"



Source: 2016 Extension Proposal

Figure 2- 2 The proposed GRiSP FPs and IDOs for 2016

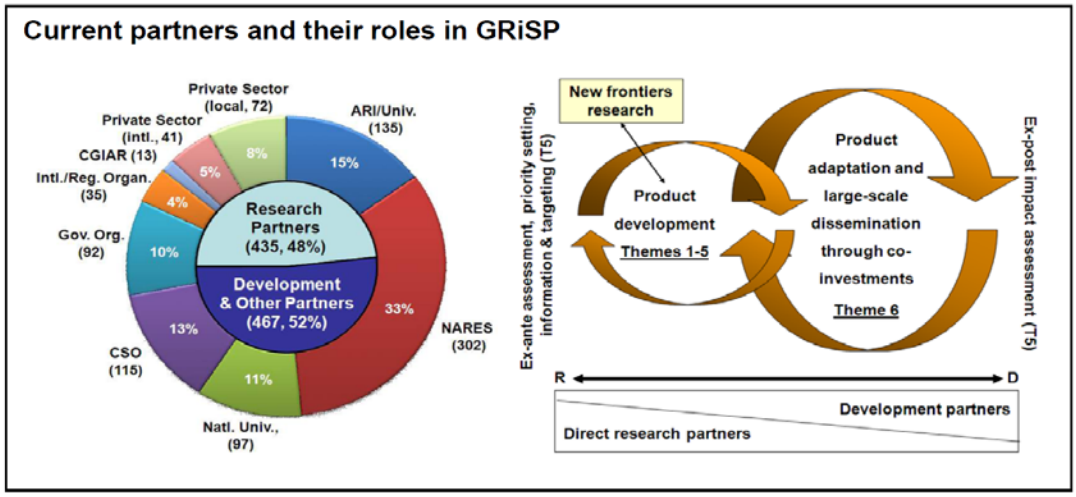


Source: 2016 Extension Proposal

2.4 Partnership

GRiSP defines its partners as primarily research partners (48%), development partners (47%) and other boundary partners (5%) (Figure 2-3). The pathway from Themes/Flagships to impacts involves an evolution from upstream science partners to downstream development partners as illustrated in Figure 2-3.

Figure 2-3 GRiSP partner types, next to partnership impact pathways



Source: 2010 proposal

2.5 Governance and management

Program management in GRiSP is largely through existing research management and administrative support systems of IRRI, AfricaRice and CIAT (see Figure 8- 1in Chapter 8). Global leadership and coordination are provided by a Program Director, a small Program Management Unit, and GRiSP's Program Planning and Management Team (PPMT). An Oversight Committee provides overall guidance and stakeholder input into strategic priorities. In 2013 USD 1.1 million was budgeted (only USD 0.7 million spent) for staff and operations of the Program Management Unit, general administrative support, and communication—about 1% of total expenditures.

2.6 Budget and expenditures

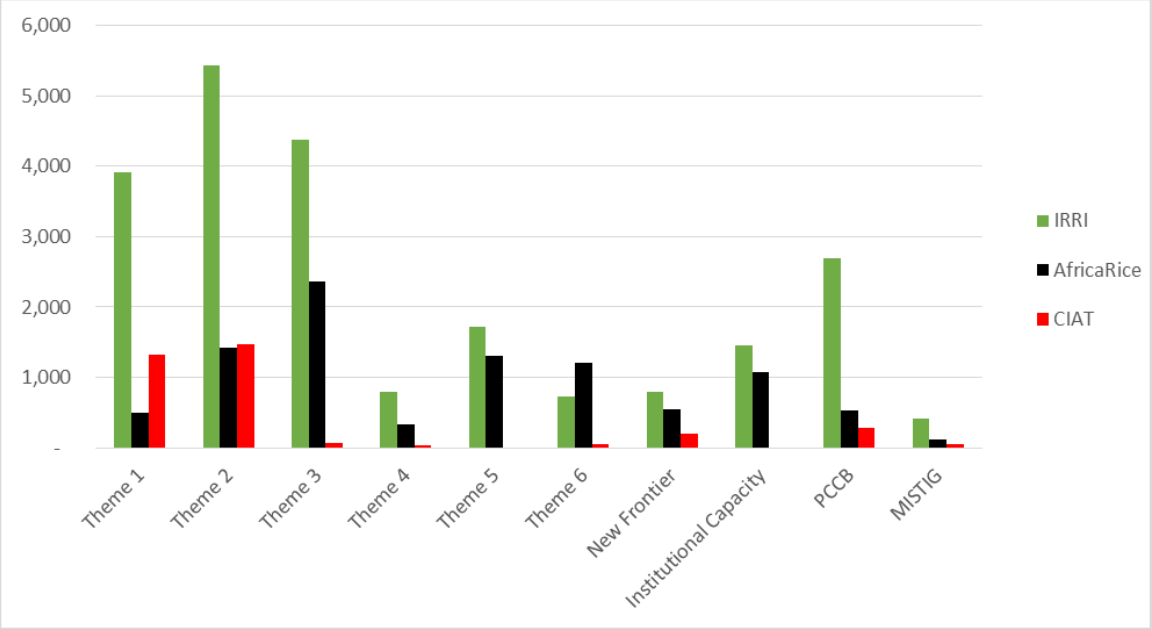
GRiSP's budget was approved for USD 593 million over five years, 2011-2015. Annual co-investments by the three core non-CGIAR partners (CIRAD, IRD and JIRCAS) were expected to exceed USD 20 million each. Additional co-investments were expected from other key partners. GRiSP's actual expenditure in the first four years has been USD 97, USD 99, USD 91, and USD 94 million, respectively.

In 2014, GRiSP non-core partner institutions accounted for 15.5 per cent (USD 14.5 million) of the total CRP budget (more than 75% to IRRI partners, the remaining to AfricaRice partners, as CIAT reported only one USD 54,000 partnership expenditure for GRiSP). Half was allocated to developing country institutional partners (including NARSs, universities and value chain organizations), and the rest to developed country and ARIs including CGIAR sub-grantees. AfricaRice's partnership spending was more than 73% to developing country partners, while IRRI's was 46%.

In 2011-2014, 37% of the expenditure was from W1/2 and 63% from W3/bilateral sources. W1/W2 funds have been distributed to centers according to an agreed formula—with IRRI receiving 64%, AfricaRice 25% and CIAT 11% (see **Box 1-1** for definitions of funding windows). W3/bilateral expenditure is managed by the individual centers. IRRI, AfricaRice and CIAT accounted for 76%, 20% and 4%, respectively, of this spending.

The 2013 W1/2 expenditure at each center for 2014 is shown in Figure 2- 4. Theme 2 is by far the largest Theme and Theme 4 the smallest.

Figure 2- 4 2013 GRiSP expenditure (USD '000) by thematic area (2014)



2.7 GRiSP portfolio

Due to the fact that bilateral funding goes directly to the participating centers, a comprehensive GRiSP database of projects and activities mapped to Product Lines (PLs), with consistent and comparable financial information over years for each participating center is still under construction. However, estimated funding for each PL is given in Table 2- 2, including bilateral grants and W1/2. Bilateral projects correspond to more than one GRiSP PL and consequently PLs comprise the funding and contributions of more than one project. Therefore, the GRiSP PL portfolio is a description of the Program from an output perspective whereas the activities contributing to these PLs are part of each center's grant and activity management.

Table 2- 2 GRiSP product lines and funding

GRiSP Product Lines (PL)	IRRI	AfricaRice	CIAT	2014 Budget (USD '000s)
PL 1.1. Ex situ conservation and dissemination of rice germplasm	x	x		1,998
PL 1.2. Characterizing genetic diversity and creating novel gene pools	x	x	x	2,917
PL 1.3. Genes and allelic diversity conferring stress tolerance and enhanced nutrition	x	x	x	4,346
PL 1.4. C4 Rice	x			5,143

GRiSP Product Lines (PL)	IRRI	AfricaRice	CIAT	2014 Budget (USD '000s)
PL 2.1. Breeding informatics, high-throughput marker applications, and multi-environment testing	x	x		8,820
PL 2.2. Improved donors and genes/QTLs conferring valuable traits	x	x	x	5,224
PL 2.3. Rice varieties tolerant of abiotic stresses	x	x	x	12,031
PL 2.4. Improved rice varieties for intensive production systems	x	x	x	8,008
PL 2.5. Hybrid rice for the public and private sectors	x	x		1,812
PL 2.6. Healthier rice varieties	x			3,402
PL 3.1. Future management systems for efficient rice monoculture	x	x		4,697
PL 3.2. Resource-conserving technologies for diversified farming systems	x			3,099
PL 3.3. Management innovations for poor farmers in rainfed and stress-prone areas	x	x		6,592
PL 3.4. Increasing resilience to climate change and reducing global warming potential	x	x		1,211
PL 4.1. Technologies and business models to improve rice post-harvest practices, processing, and marketing	x	x	x	1,699
PL 4.2. Innovative uses of rice straw and rice husks	x	x		423
PL 4.3. High quality rices and innovative rice-based food products	x	x		2,946
PL 5.1. Socioeconomic and gender analyses for technology evaluation	x	x		2,904
PL: 5.2. Spatial analysis for effective technology targeting	x	x		1,187
PL: 5.3. Global Rice Information Gateway	x	x		2,580
PL 5.4. Strategic foresight, priority setting, and impact assessment for rice research	x			504
PL 6.1. Innovation in learning and communication tools and extension capacity development	x	x	x	2,231
PL 6.2. Effective systems for large-scale adoption of rice technologies in South Asia	x			5,101
PL 6.3. Effective systems for large-scale adoption of rice technologies in Southeast and East Asia	x			454
PL 6.4. Effective systems for large-scale adoption of rice technologies in Africa	x	x		3,221
PL 6.5. Effective systems for large-scale adoption of rice technologies in Latin America and the Caribbean				280

3. Relevance

3.1 Introduction

This chapter reviews the relevance of GRiSP in addressing the system level outcomes of the CGIAR as described in the CGIAR SRF of 2011. Relevance is described from the supply side (research opportunities and payoffs, and comparative advantage) and the demand side (accounting for user perspectives).

We draw on a variety of evidence in assessing relevance. There was a significant refinement of IDOs and indicators in the 2016 GRiSP extension proposal and we use that as our base for discussion of IDOs. The original proposal and our portfolio analysis combined with center and country visits and the researcher survey largely informs the supply-side analysis. Demand-side analysis is informed by these sources of evidence as well as extensive interviews with stakeholders.

3.2 Supply side relevance

3.2.1 IDOs and SLOs

The ISPC in assessing the GRiSP proposal in 2010 stated that "The GRiSP proposal makes a very compelling case for addressing the CGIAR's objectives as defined in the draft SRF through a program on rice and rice systems. Rice is the world's most important food staple of the poor. Enhancing food security in many developing countries through yield increases and more sustainable rice supplies and systems for the poor is central to the CGIAR portfolio." Five years later in 2015, we find that this assessment remains equally valid. Rice is the world's single most important food staple in terms of calorie consumption, and even more so in developing countries where 95% of rice is produced. In many of the most populated countries of the world with high concentrations of poor people, it is critically important for incomes of poor producers and poor consumers. In Bangladesh 80% of crop area is under rice. In Sierra Leone, one the world's poorest countries, rice accounts for 45% of crop area and 46% of expenditures of the poorest consumers. It is also critical for the sustainability IDO—a large share of chemical inputs are applied to rice in Asia. At the same time, the river deltas of Southeast Asia that are the rice-baskets of the world are at serious risk from climate change.

GRiSP had three objectives that reflect the three dimensions of GRiSP strategy—genetic enhancement, efficient natural resource use and enhanced policies (Chapter 2). When asked about impact pathways, 60% of respondents to the research survey considered global germplasm development for food security the primary impact pathway of GRiSP (Annex D). GRiSP extensively refined its IDOs and indicators in the 2016 Extension Proposal. It has now seven IDOs:

1. Increased rice production that meets local and global demand
2. Increased profitability for rice producers and increased rice affordability for consumers
3. Increased productivity along the value chain
4. Increased sustainability and reduced environmental footprint of rice production
5. Increased health and nutrition from rice and from diversification

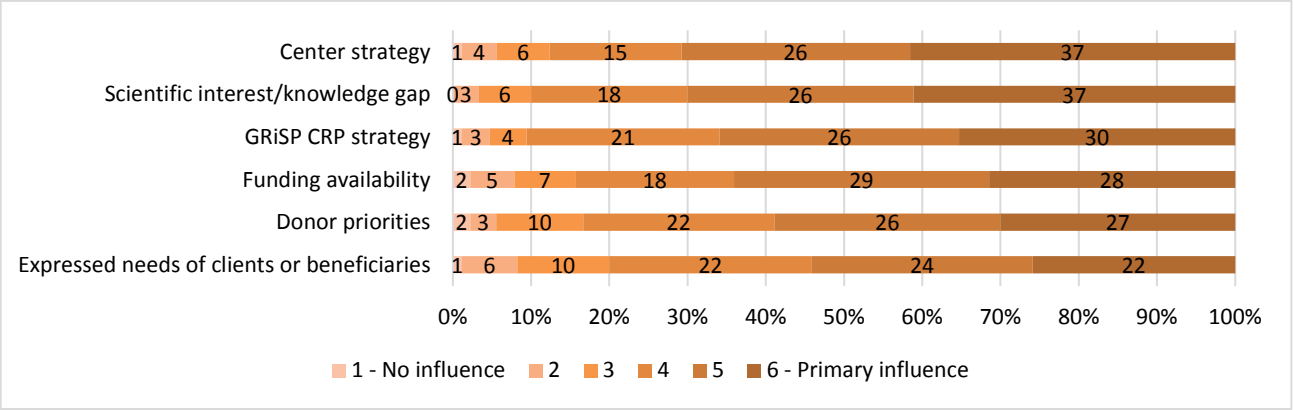
6. Increased capacity and resilience in the rice sector
7. Increased gender equity and empowerment.

As outlined in the GRiSP 2016 Extension proposal these IDOs map closely with the SLOs of the SRF. The GRiSP extension proposal also provides detailed aspirational indicators that correspond to each of the IDOs many of which incorporate the gender and equity IDO through gender-specific indicators. These IDO targets are ambitious, especially for 2020, but even if only partially realized the benefits will be huge, with beneficiaries numbering in the tens of millions of poor people and aggregate benefits in the billions of dollars annually. The setting of IDO targets in consultation with national partners has also been instrumental in developing a strong "impact orientation" among GRiSP scientists and increasingly among national scientists.

GRiSP has further work to refine its strategy re poor producers and consumers. In particular, its needs to better define its role in raising global productivity growth to reduce poverty and hunger through lower consumer prices *versus* its role in directly reducing poverty by targeting major ecosystems where poor rice farmers are concentrated. Theories of Change and especially donor bilateral projects often target direct beneficiaries—that is poor farmers—without an explicit assessment of possible trade-offs with other potential beneficiaries, such as rural laborers and poor consumers. Such an analysis could strongly influence the future priority to different rice ecologies such as irrigated, rainfed lowland and upland rice that would weigh the income and food security benefits to poor producers and consumers along with other benefits on the environmental side. A comprehensive strategy would of course, include elements designed to reach both producers and consumers and would need to be future looking. The balance over time is likely to shift to consumers especially in Asia as farm households diversify into nonfarm activities (e.g., rice now accounts for only about 10% of incomes of Bangladesh farmers) and as an increasing share of the poor are based in urban areas where they almost exclusively depend on rice markets.

According to both the researcher survey and stakeholder interviews, the GRiSP strategic framework laid out in the 2010 proposal is a valuable framework for prioritizing global rice science. In the researcher survey, 70% of scientists highlighted the GRiSP CRP strategy as a very important or important factor influencing the choice of research topics (Figure 3-1). This is significantly higher than for scientists in other CRPs where the same question was asked (e.g., IEA, 2015 on MAIZE). Stakeholders who were familiar with GRiSP (and many were not), also highlighted the strategic framework provided by GRiSP.

Figure 3- 1 researcher survey responses on factors influencing choice of research topics



3.2.2 Analysis for priority setting

GRiSP was one of the few CRPs that had initiated a formal analysis of priorities at the time of the CRP launch in 2011. AfricaRice had undertaken a detailed analysis of priorities for Africa as the basis for its 2011 strategic plan (AfricaRice, 2011; Diagne et al., 2013). That strategic plan lays out a compelling framework for investment in rice research in Africa as well as the relative balance among rice ecologies and regions. IRRI also carried out a detailed priority setting analysis although this was never published and it is unclear how much of this analysis has influenced the research agenda. Both centers used a framework based on importance of different rice ecologies, yield losses to different biotic and abiotic stresses in each ecology and expected economic payoffs to specific types of technologies, all aggregated within a standard economic surplus model that partitions benefits between producers and consumers, in the case of IRRI disaggregated by income level. GRiSP has also carried out more specific priority assessments, such as the global assessment of demand for quality traits in rice by Calingacion et al., 2014). GRiSP therefore has a solid analytical foundation for setting priorities although translation of priorities into research agenda was compromised by the type and amount of funding (more below), and the high share of legacy research included in the original proposal. Assuming that the SRF 2015 delivers a larger share of W1/W2 funding for the new round of CRPs, GRiSP has a good basis to strengthen its priority setting for its follow up proposal.

In addition, around the time of the launch of GRiSP, both IRRI and AfricaRice produced comprehensive books summarizing the state of rice science and the outlook for the rice sector (Pandey et al., 2010: Wopereis et al., 2013). These compendia provide the foundation of the foresight work that informed the design of GRiSP. However, the rice sector is changing rapidly in the wake of the 2008-11 food crisis, through rapid urbanization and income growth in both Asia and Africa, and the demographic transition in Asia. Investment in such foresight analysis needs to be a continuing activity within GRiSP.

GRiSP also has strong rice information system that combines geospatial data on agroclimatic and socio economic variables at a highly disaggregated level with advanced crop modeling. This system provides the potential for better targeting of GRiSP research to meet the wide spatial and temporal variation in rice growing environments (e.g., following the example of Chandna et al., 2012). However, the Team observed little application of the potential of this powerful tool and as a result local level research

activities often do not sufficiently account for heterogeneity, especially in the less favored rainfed environments that are a target of GRiSP.

3.2.3 Comparative advantage

GRiSP with its institutional base in IRRI, AfricaRice, and CIAT as well as CIRAD, IRD, and JIRCAS—all centers with a strong historic legacy in international rice research--has a clear comparative advantage as a global leader in some areas of rice research. This stems from its large germplasm base, its large and fast growing databases, the IPG nature of much of its research and knowledge products, its strong partnerships with national rice research systems, and the reputation of its core partners as "trusted brokers".

This comparative advantage is clearest in Theme 2 where much research is characterized by economies of scale and large potential for spill-overs. For many of these germplasm and information products there are limited alternative suppliers. Advanced national research institutes in some of the large rice producers such as Brazil, India and China have the potential to do much of this research but are constrained by national mandates and regulations on sharing germplasm and the incentives to do so. The private sector is emerging in rice, especially for hybrid rice, but it still serves a small share of the market and in any event according to interviews they are users of many outputs from Themes 1 and 2.

The biggest question is the comparative advantage of GRiSP in some of the very downstream work on technology delivery and extension such as training farmers, facilitating access to inputs and machinery services, and seed production and dissemination. In South Asia, for example, IRRI via its large bilateral projects is engaged in activities to spread technologies that in the past have been in the domain of national seed and extension systems and Non-Governmental Organizations (NGOs) and do not constitute research or science. As discussed further in Chapter 4, the Team did not discern a clear strategy for sustaining much of this work although it may well have important one-off impacts through speeded up adoption of stress tolerant rice varieties (STRVs). If the investment in extension and delivery could be built around key research questions on cost effectiveness and equity of different extension and delivery tools and business models, and tied with a clear strategy for scaling up beyond the immediate project sites, the IPG elements of these investments could be greatly enhanced and the comparative advantage of GRiSP made more evident.

The other side of this downstream focus is the relatively low investment in strategic or exploratory research. This is most apparent in Themes 3-6 but we also saw missed opportunities for more global leadership by GRiSP in some Theme 1 type activities (Chapter 6). This gap is most evident at the country level, where the strong downstream focus left little time and resources for more strategic research although some of the agronomy work in India would qualify as strategic. The researcher survey also reflected some frustration in meeting scientists' aspirations for engaging in more strategic research.

3.2.4 Appropriateness of program components

The many documents shared, presentations made and results observed in the field confirm that the GRiSP research portfolio closely maps to the GRISP IDOs, in particular, the IDOs related to increasing overall rice productivity (from unfavorable ecologies), increased profitability of rice systems (mainly through adapted varieties and new cropping systems and technology), increased sustainability (through more efficient input use), increased resilience in the rice sector, and gender equality.

The original GRiSP portfolio of six Themes that has been revised to include a value chain flagship in 2016 is also logically structured and coherent. The GRiSP framework document and its extension outline the logical links and flows of technology and information between the Themes. The organizational structures of the core partners were also adjusted to fit the thematic structure of GRiSP. Defining the Themes by discipline has facilitated interaction among core partners but at the expense of strong multidisciplinary interaction among Themes (Chapter 5).

Despite the comprehensive portfolio of GRiSP, the Team identified (subjectively) a number of gaps in the global program.

1. **Post-harvest management and value chains**. The importance of using a value chain framework has increased in both Asia and Africa, as constraints to upgrading value chains, and meeting quality standards for discerning urban consumers and exporters/importers are better understood. These issues will receive greater recognition in the GRiSP 2016 extension proposal (and even more in the Rice AgriFood Systems CRP –RAFS - proposal), but allocation of resources to this Theme/flagship appears to be very low (less than 4% of GRiSP expenditures). For example, the Team observed a traditional rice processing cluster of over 100 small-scale mills plus associated service providers in Nigeria that provides an ideal opportunity to develop an action research program on upgrading the small-scale value chain to provide wider lessons, but only minimal resources were available to address this opportunity.

2. **Pest ecology and disease epidemiology**. Although GRiSP has a strong set of research activities in abiotic stresses it appears to have under-emphasized longer term research on pests and diseases, especially in the areas of insect pest ecology and disease epidemiology, both of which are vital for rice systems undergoing rapid changes and subject to climate change. The main work on pests has focused on host plant resistance through traditional breeding and modern molecular breeding techniques, but this is only one of several pest management techniques that must be integrated into a more holistic integrated pest management systems.

3. **Global benchmarking of competitiveness.** In the wake of the 2008-11 rice price spike many countries are deeply concerned about competitiveness of their rice sector, especially the large importers but also major exporters. GRiSP has a unique opportunity to provide a global perspective on competitiveness given its presence in all three regions, and its access to

production and value chain cost data in many countries.[6] GRiSP could analyse global supply chains from the producer in an exporting country in Asia or Latin America to the consumer in an importing country in Africa in relation to domestic supply chains in order to benchmark competitiveness and analyze points of inefficiency. GRiSP could partner with other actors doing similar work (World Bank, Agri-Benchmark, PIM) to provide a truly global picture of rice competiveness across importers in all regions, and exporters from Asia and Latin America. In 2014, GRiSP led by CIRAD organised a special workshop on this topic: "Rice sectors competitiveness' drivers: lessons and perspectives" but follow up action is needed[7]

4. **Business models.** In all regions new business models are emerging to link production to millers and other actors in the value chain and tap much needed agribusiness investments into the sector. These include contract farming by millers (Benin, Uruguay, Tanzania, Vietnam, Bangladesh), land leasing and consolidation companies (China, Vietnam), cooperatives that integrate downstream to coordinate value chains (Tanzania), and large commercial farms vertically integrated with mills that invest in greenfield irrigation projects with or without out-growers (Nigeria, Ghana, Uganda, Tanzania, Cambodia). A coordinated evaluation of the relative efficiency and equity impacts of these business models could be very useful in helping countries set national rice development strategies, especially in the aspiring exporters of Asia (Myanmar, Laos and Cambodia) and the many countries aspiring to use their abundant land and water resources to achieve rice self-sufficiency in Africa. In particular, it would help countries better define the role of agribusiness in upgrading value chains.

The Team feels these are areas where GRiSP should have the comparative advantage but for different reasons. In the first case, GRiSP has already convincingly shown that a value chain approach is essential to meet quality standards for changing consumer markets and logically it needs to extend its research to integrate post-harvest with production aspects if it is to succeed in meeting market requirements. Likewise, GRiSP is already extensively engaged in pest and disease management research and upstream research is an integral part of a holistic approach. In the research on competitiveness and business models, the comparative advantage derives from the global presence of GRiSP is all the major exporters and importers of rice, although we would be the first to agree that these lines of research will require new skills and partnerships.

Despite our desire to see more exploratory research, some of the current exploratory research may not be optimal from the point of view of ensuring a future pipeline of technology and knowledge. An example is the C4 project that has built good partnerships with ARIs in upstream science but where it is hard to see payoffs in the foreseeable futures. In a more flexible funding environment, research of this type could have been structured with more tangible medium term products of greater relevance to GriSP's IDOs.

[6] AfricaRice has been collecting such data for a six country study of competitiveness although within a Policy Analysis Matrix framework that is not appropriate to the questions posed. IRRI is involved in a benchmarking study of production costs led by PhilRice and funded by the government of the Philippines.
[7] http://www.grisp.net/file_cabinet/download/0x0000afc31?1415589640

3.3 Demand side

3.3.1 Governance mechanisms

GRiSP has a number of governance mechanisms to provide stakeholder input and ownership of program priorities. These include:

1. FLAR, (Fondo Latinoamericano para Arroz de Riego) the Latin American Fund for Rice that funds most of the breeding work at CIAT is made up of over 30 public and private sector members from 18 countries who pay annual membership fees based on the size of the rice sector in the country. FLAR has a Management Committee made up of its members that meets annually to review progress and set the research agenda.

2. AfricaRice has a Council of Ministers made up by the Ministers of Agriculture of the 25 member countries who make annual contributions to AfricaRice's budget. The Governing Council meets biannually to discuss strategic issues related to rice research and development in Africa. The Council is supported by a National Expert Committee composed of the 25 Directors General of the NARS that meets annually. For setting the research agenda, AfricaRice has also established six Task Forces made up of AfricaRice and national scientists and delivery partners (See Chapter 6). These Task Forces meet annually at AfricaRice Science Week to review progress and set the research agenda. AfricaRice priorities are also informed by country strategies facilitated in all major producing countries by the Coalition for African Rice Development (Demont et al., 2013). The main downside of these strategies is the focus on country self-sufficiency rather than taking a regional view of food security—an area where AfricaRice needs to rise above the political rhetoric.

3. In Asia, the Council for Partnership on Rice Research in Asia (CORRA) made up by the public NARSs of 16 countries, including all the large producers in Asia is expected to provide important input into GRiSP design and implementation. Although CORRA is also informed by country level rice strategies that have been developed for several countries in the region, such as Vietnam and India (in progress), it still has a long way to go to provide an effective input into GRiSP design and implementation.

In addition, there are a number of other mechanisms for countries and public and private organizations to influence the research agenda, contribute funds or in kind to the implementation of the research, and aid in delivery of GRiSP technologies and knowledge products. Several of these will be discussed in Chapter 6 on partnerships including the two hybrid rice research consortia (HRDC in Asia and HIAAL in Latin America) and the Irrigated Rice Research Consortium (IRRC) made up of Southeast Asian countries (discussed in Chapter 6).

Overall the Team judges that these governance structures are providing effective stakeholder input into the GRiSP research agenda, sometimes exerting strong demand side pressure such as with FLAR and the Africa Task Force mechanism. Stakeholder interviews at the national level reveal broad endorsement of GRiSP and these governance and institutional mechanisms in particular. The major

exceptions were strong NARS, such as India and Brazil, who, according to interviews, would like a larger role in designing GRiSP and in its governance.

3.3.2 Participatory site diagnosis

Much of the location specific work of GRiSP is organized around hubs and carried out in close partnership with national programs. The Team expected to see participatory diagnostic work at those sites to guide selection of technologies for adaptive testing and dissemination. In fact, we did encounter excellent examples within GRiSP especially work on experimental auctions to assess consumer preferences in Africa and now also in Asia, and the targeting and initial evaluation of *sub1* rice through randomized control trials (RCTs). The work in the CLUES project on climate change in the Mekong Delta nicely integrates a range of multidisciplinary tools—focus groups, participatory mapping, crop modeling etc—as well as the action research by Krupnik et al. (2012) comparing the recommended production package and sustainable rice intensification (SRI) in an innovative participatory approach in Senegal.

However, we found that too many resources are allocated to routine baseline descriptive data collection to 'characterize' a site with little analysis to understand household decision making on technology and natural resource management. Likewise gender research also seems to be mostly descriptive with too little too late (Chapter 6). GRiSP scientists sometimes equate routine baseline survey work by social scientists with a needs assessment when in fact more multidisciplinary and participatory approaches are required.

The yield gap diagnostic work and participatory on-farm testing of technologies in the AfricaRice Agronomy Task Force is technically excellent, but increased involvement of social scientists could draw attention to labor and risk constraints, and gender dimensions that are critical for designing technologies in the African context. FLAR in Latin America also has an extensive outreach program in agronomy that seems to assume that 'good agricultural practice' is well known by researchers and the role of FLAR is to demonstrate Good Agriculture Practice (GAP) widely.

The overall work program leaves a big gap in depth analysis on issues of risk, labor markets, and mechanization in household decisions to better inform technology design and targeting. Understanding risks and risks management is critical to successful intervention in unfavorable environments. Likewise, large-scale promotion of mechanization, such as mechanical transplanting, will surely produce winners and losers but little *ex-ante* work has been conducted on labor markets to inform priorities and targeting. [8] This is especially true in India where mechanization is highly subsidized to the extent that market signals on resource scarcity are significantly distorted.

These observations lead to the impression that much of GRiSP site-specific work is rather supply led based on assumed GAP and suitable varieties rather than an in-depth understanding of farmers

[8] In the case of India, much of this work on labor markets and risks is being done under PIM in the CSISA project. While this work is of high quality, the team had the sense that it was quite disciplinary and not well connected to the CSISA technical themes and therefore may not be as effective as it could be. Very little of the PIM work is coauthored with GRiSP social or technical scientists.

demands and constraints coupled with carefully designed adaptive research. In some cases such as sub1 rice a supply push may be appropriate and the decision to heavily promote sub1 varieties was later backed by large scale RCTs on their superior performance under farmer conditions. However, other technologies such as Direct Seeded Rice (DSR), alternated wetting and drying (AWD) and hand weeders seem to be promoted heavily for their superior environmental benefits without sufficient evidence of their fit to farmers' resource constraints and objectives. The researcher survey also noted insufficient attention to beneficiary needs, especially in Africa.

Recommendation 1: Taking into account local institutional capacity for adaptive research, GRiSP should work with national partners to ensure that interdisciplinary research on the social, economic and natural context is used to tailor crop and resource management technologies more precisely to the needs of intended beneficiaries.

3.3.3 Donor funding

The ideal world of priority setting, whether from the supply or demand side, is tempered in reality by the complex funding situation of GRiSP (and all CRPs). Fifty eight per cent of GRiSP funds were provided by W3 and bilateral grants, rising to an estimated 75% in 2015. Since many of these grants are for 4-5 years and renewable and since such funds are quite stable relative to W1/2 funds which have been particularly volatile since 2014 (e.g., a 19% cut in the 2015 budget announced in March, 2015), bilateral grants are in effect the core funding for much of the GRiSP program. W1/2 funds can then be used to fill gaps in the program as well as provide overall coordination and management. By far the largest proportion (90%) of respondent to the researcher survey perceived gap filling as the typical use of W1/2 (Annex D).

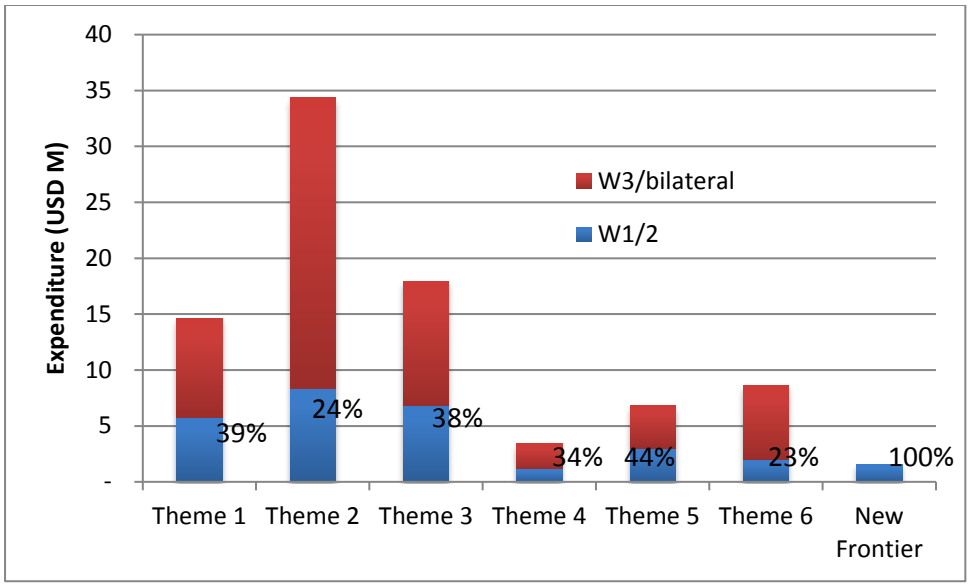
Our review of bilateral grant proposals within the framework of selected PLs of GRiSP broadly found that bilateral funds have been successfully harnessed to support the high priority activities of GRiSP, both globally and at the country level. The overall allocation reflects the high priority to breeding and gene discovery and the exploitation of this new genetic potential through crop management. Moreover, an examination of Table 2- 2 allocations by product line reveals a high priority to product lines targeted on less favoured environments in Themes 1-3 and Theme 6. If there is a gap, it is in Theme 4 on post-harvest and quality but that may be changing with the proposed flagship program on value chains beginning in 2016.

Still, compromises are inevitable in a portfolio of 160 grants of over USD 100,000 and 33 grants over USD 1 million per year from a multitude of donors. In particular, we found that in some cases large bilateral grants were pushing GRiSP further downstream into delivery than would be appropriate given the comparative advantage of the CGIAR. For example, a large part of the Cereal Systems Initiative for South Asia (CSISA) program in Bangladesh is devoted to extension and technology delivery. Reflecting donor emphasis on short-term impact metrics, GRiSP may be underinvesting in critical strategic research to ensure a pipeline of sustainable technologies for the future, especially in Themes 3-6. This observation is even more apparent for some large bilateral grants from the client countries themselves where the governments of India, Nigeria and the Philippines have all provided substantial funding for center activities focused on technology delivery.

The bulk of W1/W2 funds are allocated across the three core CGIAR centers according to a formula based on legacy funding levels—64% to IRRI, 25% to AfricaRice and 11% to CIAT. These allocations correspond closely to allocations to their respective regions (Asia, Africa and Latin America), except that IRRI provides a small amount of W1/W2 funding for its work in Eastern and Southern Africa. Funds for GRiSP coordination, new frontier competitive grants, scholarships, and gender mainstreaming, are centrally administered by GRiSP.

Logically the centers allocate their W1/W2 funds by Themes and product lines according to priority gaps in the program and this appears to be the case. IRRI allocated the most funds to PLs 2.1 on breeding informatics and PL3.1 on management systems for monoculture, neither of which was well covered by bilateral projects. AfricaRice's two largest allocations were to PL 2.1 also as well as PL3.4 on management for rainfed environments. CIAT put the largest amount of funding into Theme 1 on gene discovery. Over all GRiSP, Theme 2 on breeding received the largest amount of W1/W2 funds but W1/W2 were the smallest share of this Theme's expenditures, because of the number of large bilateral grants mapped to this Theme (Figure 3- 2). As expected Theme 6 on technology delivery also depended largely on bilateral projects. All other Themes received above average shares of W1/W2 funds in relation to their total expenditures. The allocation of W1/W2 funds to Theme 4 on post-harvest does seem low given the expressed priority to this Theme.

Figure 3- 2 GRiSP expenditures of W1/W2 and W3 bilateral funding, 2014



Source: GRiSP management

As already noted W1/W2 funding is quite unpredictable. Given the uncertainty of W1/W2 funding, the scholarship program was cancelled and no new frontier projects have been funded, leaving an even higher share of GRiSP funds allocated according to the formula. The Team sympathizes with the dilemmas in managing a fast evolving and volatile W1/W2 funding situation. However, it also recognizes that GRiSP needs a deeper analysis of the needs of rice research in each region in relation to the IDOs in order to move beyond formula funding allocation across regions to an allocation informed by expected payoffs to the SLOs. It also sees a great role for competitive funding to bring

core partners together around global strategic issues, as exemplified by the Phenomics of Rice Adaptation and Yield (PRAY) project funded through a new frontier grant (Chapters 5 and 8).

3.4 Conclusion

Overall the Team concludes that the GRiSP portfolio is strongly relevant to the CGIAR's SLOs and that the GRiSP objectives and portfolio address relevant IDOs that map to the system-level SLOs. This is not surprising for a crop like rice that is so dominant in food systems in so many poor countries. GRiSP has also carried out extensive foresight and priority setting work although the ability to translate results into funding allocations has been constrained by the dominance of legacy research activities and by the limited and declining share of W1/W2 funding. Future relevance will require a stronger engagement in foresight and analysis given the fast changing agro-ecological and socio-economic environment in many rice-producing countries. A major challenge will be to address trade-offs in benefits on the producer and consumer sides with respect to achieving the new SDGs where countries are rapidly urbanizing.

The Team does see imbalances in the portfolio with respect to the comparative advantage of a CRP--an overinvestment in extension and delivery activities in some countries and a general underinvestment in long-term exploratory research to insure the technological and knowledge pipeline—including work in genomics, pest ecology and disease epidemiology, and competitiveness. This may require a combination of re-allocating W1/W2 funding (hopefully increasing) and re-orienting bilateral fund raising toward exploratory research.

On the demand side, there are a variety of institutional mechanisms for users, especially national research systems, to influence the GRiSP research agenda and some work well, such as FLAR and the AfricaRice Task Forces. Even so at the site or hub level, the Team sees considerable scope to strengthen demand perspectives through participatory approaches and carefully designed diagnostic and adaptive research involving disciplinary skills from both the natural and social sciences.

Finally, the relevance of GRiSP is threatened by the declining share of W1/W2 funding in 2014 and 2015. GRiSP has effectively used these funds to fill priority gaps in the program when bilateral funds are not available. However, with W1/W2 funds now down to 25% of the portfolio GRiSP's degrees of freedom to fill funding gaps with W1/W2 are increasingly constrained. At the same time, with more predictable W1/W2 funds, GRiSP could gradually move away from formula allocation by center to funding larger global projects, using the New Frontier projects as a base (Chapter 8).

4. Quality of science

4.1 Introduction

Quality of science in GRiSP was assessed using a combination of analyses of the scientific output of GRiSP, performance of its scientific leaders, state-of-the art in research projects, and the processes in place for management of science quality in the CRP. These were implemented through:

- comparison of GRiSP publishing record with global rice publications (using ISI web of knowledge data base)
- bibliometric analysis of journal articles for 2011-2014 published by the three CGIAR centers in GRiSP through an assessment of journals where the articles were published and their citations (using Google Scholar)
- critical review by Team members of a random sample of 85 publications (19% of the total number) from 2013-14, as this period is more likely to represent current CRP performance than the earlier years
- review of the H-index analysis of researchers with leadership responsibilities (using Scopus database)
- a survey of researchers with questions on management of science quality
- field observations and interviews with GRiSP researchers and peers

Breeding represents a significant part of the GRISP portfolio. However, the quality of breeding cannot be assessed through publications alone since improved germplasm is a more important product. The efficiency and effectiveness of the breeding processes and the quality of the products are assessed in Chapter 5.

4.2 Scientific output and impacts

4.2.1 Rice science in a global context

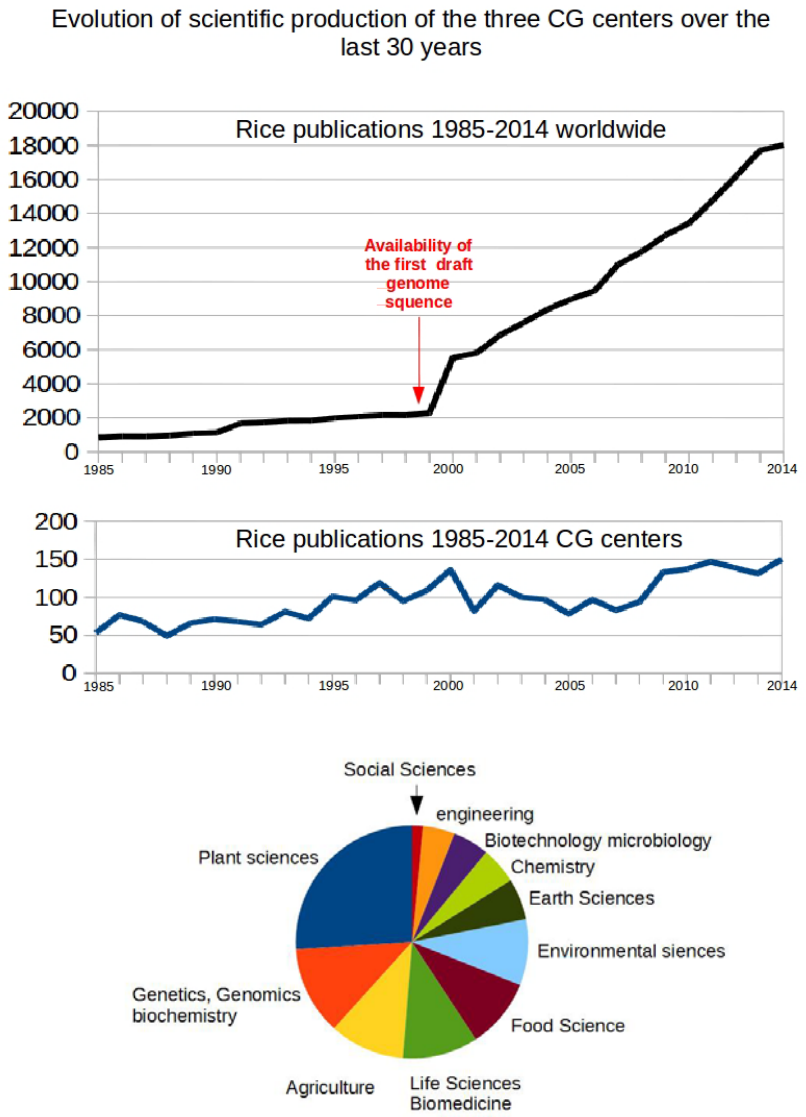
Rice is a unique case in that although it is largely a developing country crop it is universally researched because it is a model crop in genomics work due to its simple genome. Accordingly, the chapter begins with an assessment of GRiSP's scientific output in the context of global rice research.

The release of the rice genome sequence by an international consortium[9] in 2000 had a deep impact on rice science (Figure 4- 1). A ten-fold increase over the past 30 years in the number of rice publications worldwide to about 18,000 annually shows that rice has now become a model species in plant biology and motivated many new research teams globally (mostly ARIs). Noticeably, this interest

[9] The International Rice Genome Sequencing Project

does not only concern research on areas such as genomics but other topics such as environmental sciences (right hand side of Figure 4- 1).

Figure 4- 1 Trends in the global annual number of publications in rice science, 1980-2014

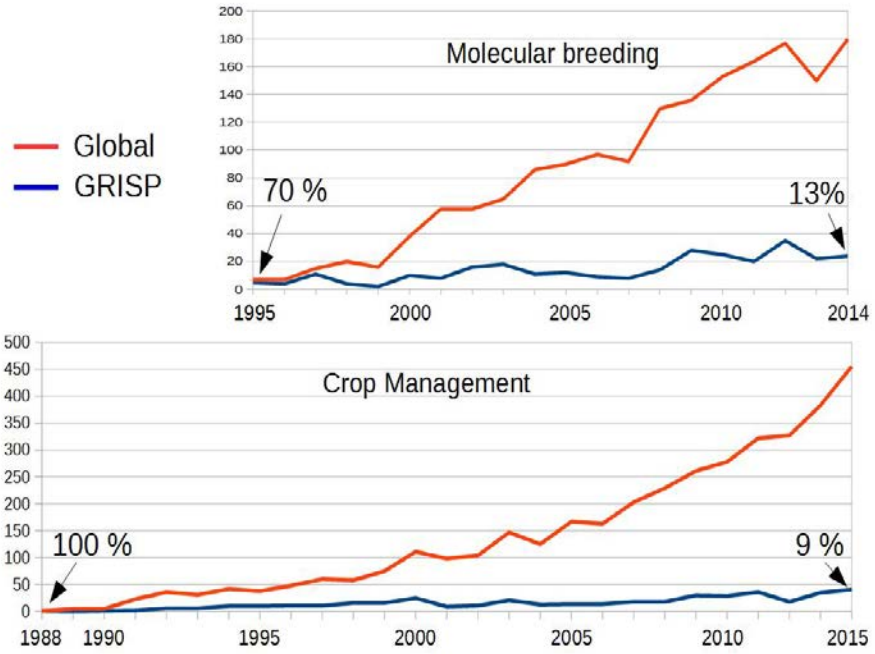


Source: ISI web of knowledge

The CGIAR contribution to global rice publications at about 150 per year has dropped from 5% of global publications in 2000 to 0.9% in 2014, suggesting that GRiSP needs to define where and how it can have leadership role in global rice research. One endeavour of GRISP should therefore be to reinforce partnership with ARIs that have introduced rice as a model species in their research activities since 2000 (discussed in more detail in Chapter 6). The three CGIAR centers in GRiSP have performed reasonably well in two areas: molecular breeding and crop management that are their core

competencies. Still they account for a small share of global output indicating that there are many other suppliers of rice science in these fields as well (Figure 4- 2).

Figure 4- 2 Trends in GRiSP publications in molecular breeding and crop management as a share of all global publications in these fields, 1988-2015



Source: ISI web of knowledge

4.2.2 GRiSP publication output

GRISP scientists have published 784 journal articles in the period 2011-2014. Of these 75% were from IRRI, 21% from AfricaRice and 4% from CIAT. The journals in which the three GRISP CGIAR centers have published their work the most frequently include the most acknowledged and appropriate journals in the different fields of research in which GRiSP engages (Table 4- 1).[10]

Table 4- 1 The most frequently used journals for GRiSP publications 2011-2014.

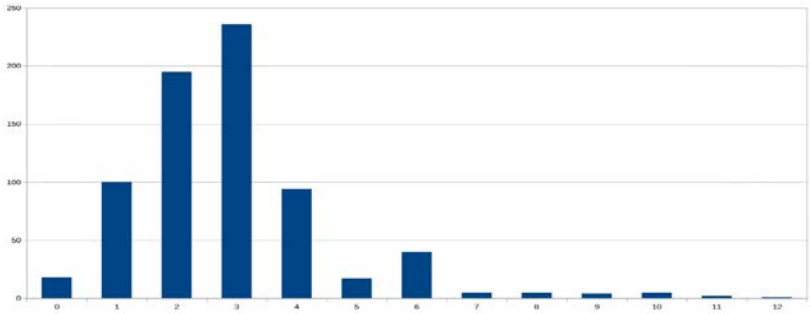
Journal	AfricaRice	CIAT	IRRI	Total	Impact Factor
Field Crops Research	11		61	72	2.61
PLoS One	3	2	21	26	3.53
Crop Protection	5		18	23	1.54
Molecular Breeding	2	1	16	19	2.28
Theoretical and Applied Genetics	3	2	14	19	3.51
Euphytica	2	1	13	16	1.69

[10] Table is based on list of publications provided by GRiSP.

Journal	AfricaRice	CIAT	IRRI	Total	Impact Factor
Rice		1	14	15	2.45
Weed Science			13	13	1.68
Plant Disease	6		6	12	2.74
Weed Technology	1		11	12	1.14
Agricultural Systems	6		5	11	2.45
Crop Science	4		7	11	1.48
SABRAO Journal of Breeding and Genetics	2		8	10	-
African Journal of Agricultural Research	9			9	0.26
Agriculture, Ecosystems & Environment	1		8	9	3.20
Journal of Experimental Botany		1	8	9	5.79
European Journal of Agronomy	3		5	8	2.92
Functional Plant Biology		1	7	8	2.57
Plant Breeding		1	7	8	1.34
Experimental Agriculture	5		2	7	1.07
Food Security	6		1	7	1.64
Phytopathology		1	6	7	2.75
Plant Breeding			7	7	1.34
Advances in Agronomy			6	6	5.02
Cahiers Agricultures	3		3	6	0.39
Rice Science			6	6	-

The Team looked at the IFs of journals in which GRiSP scientists have published (Figure 4- 3--note that the two Science and three Nature publications are not included). Acknowledging that IFs vary between different areas of research the Team considers that GRiSP is overall targeting journals with a good reputation and high visibility. However, 11% or articles have been published in journals that do not have an IF, and therefore likely lack both adequate peer review and reputation. The proportion of such articles has increased in 2013-14 compared to 2011-12 (from about 6 to 15%). Another 5% of articles were published in journals that have an IF but a low one (<0.5), mostly regional journals. The Team recognizes that in some cases the topic or audience may warrant publications in a local journal but the trend toward publication in low or 0 IF journals needs to be closely monitored.

Figure 4- 3 Distribution of GRiSP journal articles by IF of the journal.



Source: ISI web of knowledge

4.2.3 Citation of GRiSP publications

The Evaluation Team looked at citations of all GRISP journal articles from 2011-12 and the results are shown in Table 4- 2.

Table 4- 2 Citation rate of GRiSP journal articles in 2011-2014[11].

Year	2011	2012	2013	2014
N	153	186	224	195
0	2.6	7.0	14.7	35.4
1-5	17.0	27.4	47.8	56.4
6-10	20.9	21.0	19.6	7.7
11-20	27.5	23.1	12.9	2.6
21-50	20.9	15.6	6.7	1.0
>50	11.1	5.9	0.4	0.0

These data show that the GRiSP publications are moving quite fast to be assimilated into other research. Some 75% of articles published in 2014 are already being cited.

We examined the citation and authorship of the 50 most cited GRISP publications since 2011, as these can provide insights on the most visible research achievements of GRISP. The 50 most cited GRISP publications have a citation number ranging between 35 and 135. These levels of citation are significant given their time span (the range is from 80 to 592 for the world's 50 most cited rice publications). The distribution of GRiSP citations is dominated by IRRI whose scientists were author or co-author of 46 of the 50 most cited GRiSP articles, compared to 4 for CIAT and one for AfricaRice (co-authorship). This analysis also reveals that IRRI's most cited research is mostly through partnership with ARIs (40 co-authored with ARIs vs 9 with only IRRI affiliation). Considering that in many research fields first and last authorship indicate leader role, IRRI can be considered having a central position in the networks with leadership in 18 out of the 40 co-authored publications. The same analysis shows very little co-authorship among GRiSP core partners; only one of the most cited IRRI articles is co-authored by CIAT and AfricaRice and only four of the most cited articles involve JIRCAS, IRD or CIRAD.

Among the 50 most cited GRISP publications, 31 are in the fields of genomics/genetics/physiology, 2 on molecular breeding, and the remaining 18 on agronomy and crop management. This suggests GRiSP's visibility across a range of disciplines. It also explains some of the differences between IRRI and AfricaRice in their citation records. While AfricaRice has not had similar involvement as IRRI in the upstream genomics/genetics/physiology areas that are most cited internationally, it has contributed

[11] Google Scholar, June 26th 2015

a significant share of total number of publications on rice in Africa in the more applied areas, thus showing a strong regional importance of its published research. Nonetheless, research conducted by AfricaRice should often be relevant for rice producing regions of Asia and Latin America and when published in high quality journals raise the visibility of AfricaRice in global rice science.

4.2.4 Analysis of a random sample of GRiSP publications

The Team read and scored a random sample of 85 publications of 2013-2014 covering a variety of scientific fields. Major findings, applying to 70 articles that were on original research, were:

- The methodological rigor was variable, with one third of the papers assessed to be mediocre or poor, in particular for crop and resources management and social sciences.
- Comprehensiveness of narrative was overall evaluated positively, with only 23 % judged mediocre or poor.
- Novelty in methodology or findings was assessed to be standard for some 40% of the publications. The publications on pathology were an exception and 17 out of 20 publications showed intermediate or high degree of novelty.
- In terms of quality of venue, the majority of the 85 publications that were reviewed were published in appropriate venues but 25% were in journals with no IF.
- Among the publications appearing in low or 0 IF journals, the proportion rated as methodologically poor or mediocre was much higher than when articles had been published in higher IF journals.

This review reveals considerable heterogeneity of quality and suggests more variability for some disciplines such as social science that is not well represented in the citations data set analysed above. Other findings such as lack of novelty may not be an issue since a good deal of research is routine although it needs to be methodologically well done. However, the publication of a significant quantity of articles in lower quality journals is a concern.

4.3 Quality of researchers

The quality of researchers was assessed in part through the H-index bibliometric parameter, which was analysed for 94 GRiSP researchers with a project leadership role. The results are shown in Table 4-3 for each GRiSP CGIAR Center grouping the H-index results in four categories from low to high. The H-index has been subject to debate regarding its relevance, mainly because it is influenced by both the age of the researcher and the area of expertise (biased towards senior researchers specialized in research disciplines where citation is high). Therefore only research project leaders were included in the analysis.

Table 4-3 Results of H-index analysis of GRiSP research leaders by center (based on H index as reported in Google Scholar)

Center (No. of researchers)	Median H-index	% of researcher leaders in H-index categories			
		0-5	6-10	11-20	>20
IRRI (61)	12	31.1	13.1	31.1	24.6
AfricaRice (19)	6	40.0	40.0	15.0	5.0
CIAT (13)	7	38.5	38.5	7.7	15.4

The H-index of the 94 GRISP project leaders varies between 0 and 47, with one researcher above 40, 9 above 30 and 18 above 20. One third of IRRI research leaders and about 40% of both Africa Rice and CIAT research leaders have an H-index of 5 or less. Given that these researchers are expected to lead research and mentor younger researchers, these proportions are quite high. The centers, responsible for scientist performance, should incentivize joint research and publishing in good quality journals to boost also the scientific credentials and recognition of those scientists who are at the low end of the H-index scale.

Recommendation 2: GRiSP management should encourage and incentivize stronger research collaboration among GRiSP centers and their partners in ARIs for improving the overall quality of the scientific output through jointly authored, high quality publications.

During field visits and interviews the Team members also observed aspect of scientific leadership. Overall, the Team was impressed with leadership and commitment of the principal investigators across the three centers and the non-CGIAR core partners. This was particularly true regarding the out-posted scientists many of whom are working in difficult environments, especially in Africa, which poses challenges to research and getting it published in high quality international journals.

4.4 Qualitative assessment of social science

Social science quality may require different metrics and scientific literature data bases to those for the natural sciences that were used in the analysis for this chapter. Using other evidence, the case studies and the review of a sample of publications, highlighted two elements of social science quality.

First, quality is quite variable with some outstanding work. Excellent examples of high quality of science are provided by:

- RTCs on Sub1 rice showing household dynamics with reduced technological risk
- Experimental auctions on consumer willingness to pay in Senegal and other countries of West Africa and related work on country rice development strategies.
- Assessment of impacts of NERICAs in Africa.

- Assessment of the impacts of the 2008 food price spike on poverty in Bangladesh

On the other hand, much of the work is highly descriptive and published in working papers and reports that do not make it to journals, or if it does, it is published in mediocre journals. The plethora of baseline surveys has distracted much of the social science work from cutting edge and/or problem-solving research.

Second, some of the research including some rated high on quality is quite disciplinary and outside of the scope of the main GRiSP program. It seems that social scientists have been quite opportunistic in exploiting available databases for publishable articles even if it is not central to GRiSP. However, much of the social science work in GRiSP needs to be interdisciplinary (Chapter 5) and a greater effort is needed to find good quality publication outlets for this type of research. Fortunately some of the most innovative and professionally recognized research in social science today is from working with other disciplines to apply economics concepts to new fields and problems. Mainstream GRiSP work is ideally situated for this. Stronger partnerships with ARIs may be needed to bring in fresh social science tools, as illustrated by the work on RCTs and experimental auctions.

4.5 Research infrastructure

The Evaluation Team observed facilities and infrastructure for research during its visits to the three CGIAR center headquarters. With some variability, the quality of the facilities is high and suitable for the type of research conducted. GRiSP research also benefits from the excellent facilities by the non-core partners. In responses to the researcher survey (Figure 4- 4) 27% of respondents (majority of them from AfricaRice) expressed some level of concern regarding the accessibility and availability of technical facilities and equipment for high quality science. AfricaRice facilities for marker-assisted breeding (MAB) in Senegal are the least developed, but markers are being used routinely in the various projects of the center. High throughput platforms have been implemented in IRRI, IITA (International Institute of Tropical Agriculture - with access for AfricaRice) and CIAT.

4.6 Management of science quality

For its assessment of the processes in place for assuring and enhancing science quality, the Evaluation Team considered the use of external reviews and solicited views from GRiSP researchers on aspect of management related to science quality. Only AfricaRice has used the Center Commissioned External Reviews during the period of implementation of GRiSP. One AfricaRice Board of Trustee (BoT) member concluded that such reviews are the only mechanism for center BoTs to exercise their oversight role regarding science quality. AfricaRice had completed three Center-Commissioned External Reviews (CCERs) by mid-2015 covering the period of GRiSP[12]. The quality of these reviews was good in two cases and the process included appropriate management response. External reviews of the large

[12] One on Policy, Innovation Systems and Impact Assessment, one on Genetic Diversity and Improvement Program, and one on Sustainable Intensification.

bilateral projects such as CSISA and STRASA (Stress Tolerant Rice for poor farmers in Africa and South Asia) programs also provide evaluative information for management, although these were commissioned by the main donors. The CSISA review concluded that the high quality of program management was reflected in many aspects of the program, including quantity and quality of creative research.

The survey of GRiSP researchers showed a high level of satisfaction with the way management is addressing issues of science quality (Figure 4- 4). The respondents were most critical about aspects of risk taking and learning from failure where nearly 50% of them showed some level of concern.

Figure 4- 4: Researcher survey responses on management of science quality

Monitoring systems and their use by management should build in acceptance of risk, and analysis of unexpected results for facilitating ongoing learning as part of the research process.

4.7 Conclusions

Despite a very competitive global context, GRISP scientific output can be considered as significant. GRISP has published major papers that are already highly cited despite their recent date of publication. This was achieved with a sound management of research projects, a strong involvement of most researchers in the global scientific community, and a good partnership with ARIs for expanding the scientific input.

The Evaluation Team has nevertheless noticed that there are too many publications in minor venues, with no or very low impact factors (IF) which puts the quality of the peer review mechanisms in doubt. In addition, IRRI stands out among the three CGIAR centers in terms of scientific output and impact of their publications. The scientific output of AfricaRice and CIAT is much less visible, both in terms of quantity and citation. The number of scientists in the CIAT sample is too small to draw definite conclusions although the Team was impressed with quality of science presented there and its partnerships with ARIs. There are also reasons why AfricaRice may score lower on the publication metrics, including the youth of its scientist (affecting the H-index), the relatively more applied and

adaptive orientation to its research and the small community of rice scientists in Africa. Nonetheless, to recruit and maintain highly qualified scientists in a global market place, AfricaRice needs to continue to push for improving its performance in quality of science through appropriate incentives and support, continuation of the CCER process, and deeper integration and collaboration with GRiSP partners and with ARIs.

Finally there are differences in science quality across and within disciplines. Social science quality may require different metrics to those for the natural sciences that were used in the analysis for this chapter. The case studies and review of publication highlighted two elements of social science quality. First, quality is quite variable with some outstanding work and other publications that do not meet international standards. Second, some of the research is quite disciplinary including some rated high on quality but outside of the scope of the main GRiSP program. GRiSP offers great opportunities for highly relevant and innovative interdisciplinary research and stronger partnerships with ARIs are needed to tap this opportunity and build social science quality.

5. Likely effectiveness

5.1 Introduction

This chapter evaluates effectiveness of GRiSP through progress made in reaching its milestones and outcomes, and the likelihood of the program in achieving its IDOs. The evaluation was based on case studies, interviews, field visits, project proposals, reports and publications. Here we comment on the strategy for scaling up, progress in reaching milestones, synergies with partners and effectiveness at the Theme level.

5.2 Theory of change and the strategy for scaling up

GRiSP is generally effective in progressing towards the IDOs, by adhering to its strategic framework and impact pathways. The recognition of the multiplicity of opportunities for development effects is reflected in 6 Themes, 26 product lines and 94 products, each one with 2 to 10 milestones for outputs and outcomes for 2011-15.

Specific needs and opportunities of the major rice agro-ecosystems are delivered by research products, which also account for differences in markets and consumers' preferences. The needs of partners, including farmers, governments, NGOs and private companies, are addressed, sometimes with participatory approaches, such as those for impact pathway analyses (PIPA) or variety selection (PVS). Although GRiSP recognizes that ToCs need to be designed to each of these contexts, and eventually to each site or hub, the process of refinement is still incomplete.

Effectiveness in scaling up varietal technologies in stress-prone environments has been clearly demonstrated in bilateral projects in Eastern India and Bangladesh. Some varieties appear to be ready for outscaling beyond areas directly under the influence of the project. New models for seed multiplication and targeted delivery systems are effective and transferable. In South Asia, the results are impressive – new STRV released since 2010 reached about 11 million farmers and covered nearly 5 million hectares. In the year 2014, more than 258 K tons of seed of STRV were distributed to farmers in Asia.[13] These milestones are difficult to verify, but indicate that GRiSP has more than tripled its original milestone target.

On the other hand, the strategy for scaling out other types of technologies, like crop management and post-harvest techniques, is not well defined. Active engagement of GRiSP scientists and support staff in delivery, as observed in South Asia under CSISA, can function as demonstration of delivery models. However, if GRiSP projects do not leverage the development of local capacity, benefits may not be sustained and scaled out after the end of the project. Little evidence was found on the effectiveness

[13] STRASA Phase II Final Report, 2015 and GRiSP 2014 Annual Report, 2015

of the products described as "New models for jointly building extension capacity" (Products 6.2.3, 6.3.3 and 6.4.3), especially a new breed of extension agronomists.

GRiSP involvement directly in delivery activities for management and post-harvest technologies can only reach a small percentage of the total target population (in Chapter 3, the program's comparative advantage in these activities has been questioned). The current ToC fail to explicitly articulate secondary pathways to reach the millions. This will inevitably involve a stronger partnership with public and private development partners, including donor-funded development projects. In particular, public extension systems have the network of people on the ground (Chapter 6). Although it is known that the majority of the national agricultural extension services are fragile, there was little evidence of efforts from GRiSP to encourage the upgrade of extension agencies, or even analytical work to help identify the major constraints on extension systems as indicated in the original GRiSP proposal. GRISP should consider, in its next phase, modifying its paradigm of demonstrating impact through adoption at specific sites, to one of researching the cost effectiveness and equity of tools, methods and business models for upscaling through public and private development partners, accompanied closely by CapDev of partners who can implement the best models.

Recommendation 3: GRiSP should articulate a strategy for scaling up and scaling out beyond its immediate beneficiaries, by researching methods and business models for effective and equitable delivery, especially for management and post-harvest technologies, coupled with capacity development of relevant partners.

5.3 Progress in reaching milestones

Overall, GRiSP has been fairly successful in reaching its original milestones and in adjusting its work program accordingly. While the Team found that GRiSP does not yet have an integrated M&E system (see Chapter 8), monitoring takes place at GRiSP milestone level and results are used for adjusting the work plan. In the researcher survey, 60% of respondents gave the management of "annual progress monitoring" for enhancing effectiveness a rating of 5 or 6 (reflecting good management). In 2013, some of the delayed milestones were cancelled and new milestones were added, which is a legitimate re-planning for a large program. Several milestones of Theme 2 were delayed by the end of 2014, although significant progress was achieved, including gene discovery, trait development and breeding remodeling. Therefore, we conclude that the delays were more a consequence of over-ambitious milestone setting, than a matter of non-effectiveness. Target setting should be more cautious in future proposals.

GRiSP is also on track according to the quantitative indicators of the CGIAR M&E system. Some of those indicators suggest impressive progress, such as the 7.7 M farmers that have applied new technologies on 4.7 M ha by 2014. Such accomplishments are consistent with the evidence of impact, reviewed in Chapter 7.

5.4 Synergies among GRiSP core partners

GRiSP has made a strong effort in building synergies for enhanced effectiveness through collaboration among the core partners. The increased collaboration between IRRI, AfricaRice and CIAT builds on a legacy of active discussion about CGIAR rice research, which started in 2007. GRiSP implemented this visionary collaboration in 2011 when the CRP became effective.

The seven New Frontier projects started in 2011, through a competitive call under W1/W2 funding, have been very effective in leveraging partnerships, considering the modest funding committed to that call. For example, the PRAY Project (*"Phenomics of Rice Adaptation and Yield"*) gathered scientists from IRRI, AfricaRice, CIAT, Embrapa, the Chinese Academy Of Agricultural Sciences (CAAS), CIRAD, the National Institute for Agro-Environmental Sciences (NIAES), University of Queensland and Philippine Rice Research Institute (PhilRice), in the most inclusive network for upstream research within GRiSP. The immediate goal of the project is the evaluation of two rice diversity panels, one of *indica* and one of tropical *japonica* rice, for traits related to yield potential and stress tolerance, and applying GWAS (genome-wide association studies) with available genotypic data. Working as a coordinated network has created the conditions for more efficient use of resources, including a standardized methodology, high throughput phenotyping tools, site characterization, genotype-by-environment analysis, model-based phenotyping, combination of morphological, physiological and biochemical data and validation of traits affecting yield components.

The MENERGEP project, led by AfricaRice in collaboration with IRD, JIRCAS, CIRAD and IITA focuses on genetic diversity of pathogens and resistance genes that are effective in each region of Africa. Partners strongly endorsed this project during our stakeholder interviews.

The "New Frontier Projects" are good models to integrate efforts to address scientific challenges of global significance. By expanding the number and size of such projects (if needed by reducing formula allocations to centers), GRiSP could build stronger commitment among core and collaborating partners. Deeper integration will also involve greater specialization among core partners, so that those with the best expertise in a particular research area take a global lead role and give support to others in the network.

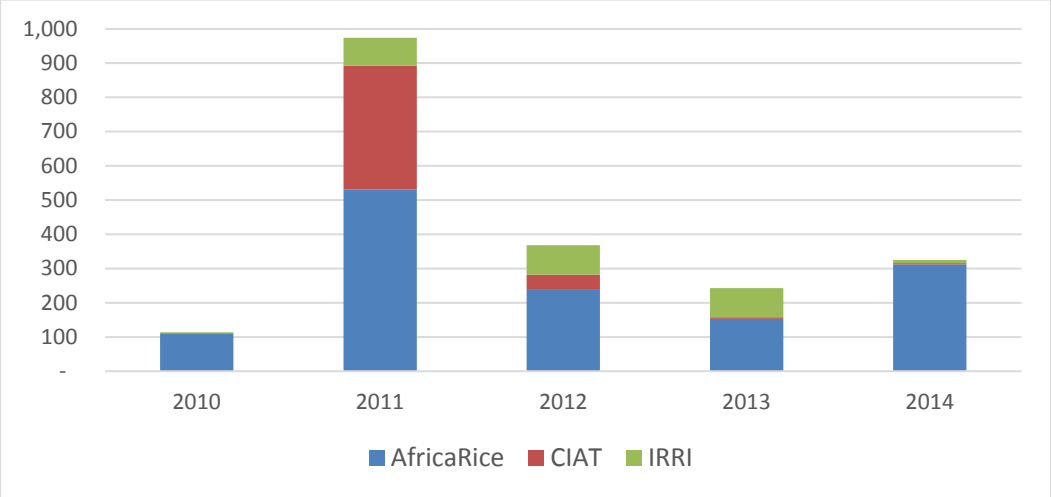
Specialization is beginning to emerge within GRiSP, with a potential to enhance its overall effectiveness. For example, CIAT has comparative advantages for genetically modified (GM) rice research: facilities for efficient rice transformation; a generic permission to test GM rice in contained field; absence of natural wild rice populations at CIAT's surroundings, preventing transgene flow; strong collaboration with ARIs and a favorable socio-political environment for GM research in Latin America. With all those advantages, CIAT could play the role of a hub for rice genetic engineering and provide services for other GRiSP partners. Specialization is also well advanced in the area of gene discovery among other innovative biotechnologies where IRRI, CIAT, CIRAD and IRD have a clear comparative advantage compared to AfricaRice, which is mainly a user of the markers developed.

The non-CGIAR core partners are also involved in several collaborative projects with the CGIAR partners. CIRAD has scientists at CIAT, IRRI and AfricaRice, whereas IRD has scientists at CIAT. The permanent presence of staff members facilitates the interaction between institutions. Even so,

increased interaction has yet to be reflected in increased co-authored papers across the core partners (see Chapter 6).

GRiSP has accelerated the exchange of germplasm and Quantitative Traits Locus (QTLs) among core partners. For example, entries into the MET trials of the ARBTF in 2011 and 2012 included many contributions from CIAT and IRRI (Figure 5- 1). Collaboration on breeding STRVs has also been promoted between Asia and Africa by the STRASA project, which provided for annual planning and review meetings between IRRI and AfricaRice. Hybrid rice research was also favored by the active collaboration between CIAT and IRRI, through mutual visits and exchange of inbred lines and methodologies.

Figure 5- 1 Number of entries from CGIAR centers in the multi-environment trials (MET) of the ARBTF.



Source: AfricaRice

Interaction in other Themes (3-6) has also been intensified through global thematic workshops and interchange of tools and methods. However, there is yet relatively little active collaboration in agronomy, post-harvest and social sciences, reflecting, in part, the greater site specificity of much of this work.

While GRiSP has made good progress in building global synergies, it failed to implement full collaboration between AfricaRice and IRRI regarding their work in Eastern and Southern Africa (ESA). Given that this is the one region where both centers are working, the region has the potential to be the showcase of collaboration within GRiSP, adding value and reducing operational costs through partnership. However, after a failed attempt to run an integrated program in Tanzania, IRRI moved its regional headquarters to Burundi. The two centers split the rice agenda, IRRI with lowland rice, AfricaRice with upland rice and, to some extent also selected different priority countries. Stakeholders interviewed were confused about the roles and mandates of the two centers in the region, and certainly did not view their work as an integrated program. Allocation of responsibilities of centers by agroecosystems should be avoided, since it precludes any possibility of synergy between the teams.

While the Team recognizes that there are bureaucratic, cultural and institutional difficulties to making the two teams to work as if they were a single team, it is necessary that these obstacles be overcome

in ESA. The Team believes there is an important role and space for both centers in the region. Given the mandate and governance structure of AfricaRice with countries from the region now joining the Council of Ministers of the Center (e.g., Uganda), Africa Rice should have the coordinating role for the region. At the same time, Africa Rice should recognize the complementary assets and skills of IRRI in the region, including a long tradition of working there, and pro-actively encourage IRRI's and where appropriate, CIAT's, participation in a truly integrated program that avoids territorial and programmatic mandates and exploits synergies.

Recommendation 4: GRiSP should without delay deliver a single integrated rice research program in Eastern & Southern Africa, coordinated by AfricaRice and drawing on the relative strengths of *both* AfricaRice and IRRI, in order to improve efficiency and complementarities, and enhance the image of GRiSP among its stakeholders in the region. This recommendation should be implemented prior to the commencement of the second phase of GRiSP (the CRP on rice agrifood systems).

The partnership in ESA is only one opportunity to deepen partnership within GRiSP. GRiSP is still in its early stages and the scope for integration in this first stage was limited by the dominance of legacy research developed independently by the core partners. In the future, the core partners should be able to achieve much greater integration by designing research programs from the bottom up. For example, by moving away from formula allocation of funds across centers and expanding the number and size of global projects such as the New Frontier projects it has the opportunity to build a truly integrated research program around scientific challenges of global significance. Deeper integration will also involve greater specialization among the core partners so that those with the best expertise in a particular research area take a global lead role.

5.5 Effectiveness by research Themes

Considering that GRiSP progress has not been made at equal pace in all Themes, specific comments are made below on the efforts by groups of Themes in contributing to GRiSP effectiveness. Efficiency of the breeding process and the quality of the genetic materials produced are also attributes of quality but assessed here as part of effectiveness rather than in Chapter 4.

5.5.1 Trait discovery and breeding (T1 and T2)

GRiSP gave high priority to stress-prone environments, and the gene/genomic work, trait discovery and breeding pipelines have effectively targeted the appropriate stress factors. The iconic product of this work has been submergence-tolerant rice varieties (containing the *Sub1* gene), which reduce yield losses in flood-prone areas and promote equity by disproportionately benefiting the most marginal groups of farmers (Dar et al., 2013). The heavy promotion of *Sub1* varieties is backed by large-scale RCTs on their performance under farmer conditions. The *Pup1* gene, for P uptake efficiency and tolerance to P-deficient soils, developed in collaboration with JIRCAS, is also very promising in India.

The Team considers the GRiSP trait pipeline to be very effective. This effectiveness starts with sound priority setting, with focus on traits that have a high chance of preventing losses and increasing yield potential in challenging environmental conditions. Such conditions are expected to worsen under

climate change. Following the success of *Sub1* and *Pup1*, IRRI continues to explore novel sources of tolerance (submergence during germination, stagnant flooding, drought, salinity, iron toxicity and diseases), identifying QTLs, mapping major genes and developing selection tools for enhancing breeding efficiency. Map-based cloning of genes of agronomic interest is now an established routine in the trait pipeline. For instance, 4 QTLs for salt tolerance and 3 QTLs for drought tolerance are being cloned and these should soon be available to breeders, although the complexity of these traits might reduce their effectiveness, in comparison with Sub1 or Pup1. The trait pipeline also includes the search for genes contributing to high-yielding ideotypes. QTLs and genes for agronomic traits and yield components have been detected in collaborative research between the CGIAR centers and ARIs, e.g., early vigour (CIRAD/CIAT), high tillering and grain weight (China/IRRI), and spikelet number (Japan/IRRI).

The new breeding methodology adopted by IRRI for rapid generation advance (RGA) integrates classical breeding, molecular genetics, biotechnology and information technology. With this strategy, the time required between gene discovery and its deployment in the field can be reduced by about 3 years, compared to conventional pedigree breeding systems. This “product-oriented, market-driven” breeding program, with an explicit goal of accelerating genetic gains for yield, is theoretically sound and builds on the recommendation of the 2009 external review of IRRI.

Although both the trait pipeline and the breeding pipeline are effective, the milestone of a 10% increase in yield potential of irrigated rice by 2015 is unlikely to be reached. The Team considers this milestone to be over-ambitious target for the short time period of GRiSP. GRiSP is creating the conditions for this milestone to be met in the medium future. It is important to assure continuity of the new breeding approach, along with the gene discovery pipeline, for at least 10 years, when its effectiveness, represented by the cumulative yield gains, will become statistically verifiable.

GRiSP breeding lines are directly released by partners or used as parents in NARS breeding programs. An impressive number of GRiSP-derived varieties has been released by national programs in 2012-14 (Table 5-1). Release of early maturing varieties in South Asia, combined with management technologies, such as zero-tillage and DSR, have been effective in increasing cropping intensity and productivity, especially in the rice-wheat areas of Bihar (CSISA, 2014). STRVs have also been released by national breeding programs in many countries in Asia. In field visits, the Team observed the success of rice with tolerance to other stresses, especially drought and salinity tolerance and these advances are ready to be verified by rigorous testing.

GRiSP is developing innovative partnerships with the seed sector to speed the transfer of novel varieties to farmers. In Asia, it has collaborated with seed companies and in at least two cases is supporting the development of private rice breeding programs for self-pollinated varieties. In Latin America, FLAR has been effective in reaching many countries with improved materials, especially those in the tropical zone. FLAR has direct connection with farmers associations in ten countries and with private seed companies in six countries. In Africa, where the private seed industry is less developed, AfricaRice has supported the development of seed associations and nurtured the emergence of new seed companies. In Nigeria, AfricaRice supported the acceleration of certified seed production from 2,000 t in 2010 to 76,000 t in 2014. One concern is the very high number of varieties released in some countries and years (e.g., 16 varieties released in Mauritania and 9 in Sierra Leone,

in 2013), which adds more complexity to the seed supply chain. It appears unrealistic that countries with fragile seed system could simultaneously incorporate several new varieties into the rice value chain.

Table 5-1 Varieties released with GRiSP parentage (IRRI, AfricaRice and CIAT)

Year	Asia	Africa	Latin America	Total
2012	33	9	10	52
2013	44	62	7	113
2014	28	21	6	55
Total	105	92	23	220

Source: GRiSP Annual Reports 2012, 2013, 2014

Another major accomplishment toward making rice breeding and varietal release more effective was the implementation of regional reciprocity agreements between countries. Such an agreement is now working in West Africa under the Conceil Ouest et Centre Africain pour la Recherche et le Développement Agricoles (CORAF). In 2014, IRRI helped broker a similar protocol to fast-track registration of varieties from across India, Bangladesh and Nepal, allowing easy flow of varieties across the borders once they are released in one of the three countries.

Breeding in Africa. Providing rice varieties for Africa is even more complex than in Asia and Latin America, because pest and disease pressure is higher and the great majority of the rice area is rainfed. The suite of traits needed include drought tolerance (lowland and upland conditions), extreme temperatures (heat and cold), submergence (flash flooding, standing water), salinity, resistance to pests and diseases (Rice Yellow Mottle Virus (RYMV), Stem borer, Termites, African Rice Gall Midge (AfRGM), Bacterial leaf blight (BLB), blast) and low soil fertility (P, Zn, etc.).

Simply introducing high yielding varieties from Asia or Latin America will not be effective in many cases, especially if they do not meet grain quality preferences of each country. For example, Chinese elite lines from the Green Super Rice Project tested in Tanzania perform well in terms of yield but the lack of aroma hinders adoption. Rice varieties from Brazil should perform well in West Africa, but they must be tested for resistance to rice pests common in Africa and absent to Brazil.

The 2015 CCER on the genetic diversity and improvement program of AfricaRice recommended that AfricaRice should continue their MAS approach using validated markers for desired traits and target breeding populations rather than engaging in gene discovery and DNA marker development, which can be either undertaken through partnership research or done by outsourcing. Therefore, it is clear that the effectiveness of the trait pipeline for Africa will require strong and efficient coordination between AfricaRice and other partners, especially IRRI, such that partners put more emphasis on the trait pipeline for African problems and pass the results to AfricaRice's breeding program. AfricaRice has an excellent mechanism to test varieties and build NARS's capacity through the ARBTF. It should focus on positioning traits in target environments and promoting the seed systems for final impact. Of special relevance is the systematic selection for pest and disease tolerance in hotspots through the ARBTF, coupled with pathogen diversity analysis and marker-assisted selection.

The Team believes that the breeding pipeline in Africa must be strengthened to be effective in face of the challenge of providing high-yielding varieties for the many rice environments in the continent. Although much has been achieved, the AfricaRice breeding program is still not strong enough to effectively feed the ARBTF with a sufficient number and diversity of elite lines for all relevant environments.

The return of AfricaRice headquarters to Bouaké should create conditions to build a true hub for housing the base of a continental breeding program, with strong ties with GRiSP partners, on the one hand, and with the ARBTF on the other hand. The experience of IRRI's "Transforming Rice Breeding" Project should be assessed for lessons in establishing a product-driven breeding program for Africa.

Recommendation 5: AfricaRice should modernize and intensify its rice breeding program for feeding elite lines to the ARBTF, for all major rice ecosystems in Africa. GRiSP core partners, especially IRRI, should give support to the African program, developing traits and elite populations targeting African needs.

5.5.2 Sustainable management of rice-based systems (T3)

GRiSP recognizes the importance of sustainable site-specific management to realize the potential of high-yielding or stress-tolerant varieties. The adaptive and participatory experimental platforms for efficient and sustainable rice systems are likely to contribute to improving effectiveness of crop management technologies, by enabling them to be integrated into farmers' practices. Climate change concerns have also begun to give new impetus to rice management technologies, especially in the Delta 'rice baskets', which are the most vulnerable environments.

Much of the research on sustainable management revolves around the emerging constraints of water and labor scarcity. GRiSP has delivered many products that proved effective in saving irrigation water and labor, including eliminating puddling, DSR, AWD and laser levelling. However, uptake has often been less than anticipated, in part due to the site-specific nature of many practices and the need for adaptation to these situations. For example, one survey in India found that 43% of farmers that had tried DSR in 2009-2012, were not using the technology in 2012 (Yamano et al., 2013). Despite the saving of time, labor, and water, the many functions provided by the practice of transplanting into puddled soil have still to be compensated in dry direct seeding. GRiSP products for water management could be more effective if the different objectives of water resource management are more precisely characterized, and a clear distinction made between saving water and managing its scarcity and uncertain supply.

A weakness in much of this research is the focus at single field level, with insufficient attention to effects at landscape level. This is especially relevant for wider adoption of AWD, in spite of its consistent water savings. National partners who have tested AWD (e.g. Cambodia, India, Thailand and Vietnam) invariably reported the difficulty in coordinating the practice among neighboring farmers. AfricaRice's participatory 'Sawah System Development' (SSD) approach to develop or rehabilitate wetland rice production illustrates how a ToC for rice management technologies should take into account management of land and water at the community level (Djagba et al 2014; Rodenburg 2013; Rodenburg et al 2014).

In Asia, GRiSP GAP/BMP (good agricultural practice/ best management practice) are being adapted to management standards of each country (e.g. TPIRP in Cambodia, BMP in Indonesia, VietGAP in Vietnam, GAP in Thailand) with a strong emphasis on sustainable input use to enhance environmental outcomes. When combined with attainable yield potential for each location (measured by the difference between the best and average farmers' yield) GAPs have been reported to be effective in increasing productivity, especially by lowering the cost of production through reduced input use. In Vietnam, these are incorporated in a national 'one must do, five reductions' campaign that reaches a large number of farmers through a partnership with a World Bank development project.

GRiSP has given limited attention to the relevant ecological processes underlying long-term sustainability, although sustainability is a critical concern for irrigated intensive rice systems. Notable exceptions are the work on rice-wheat systems that has been going on for decades now, and the ecological approach to rodent control (which accounts for a large share of Theme 3 publications on pests).

GRiSP research on the physiology of the rice plant in response to stresses has provided important feedback to the trait and breeding pipeline of stress tolerant rice varieties. Additionally, it can contribute to better management of those varieties, when they are deployed in the field.

For the future, research on crop and natural resource management, directed at immediate impacts, should be better balanced with studies for understanding the physiological and ecological processes in rice-based systems. For example, too little attention has been given to the weedy rice situation in SE Asia, which has resulted from natural cross fertilization between the ubiquitous wild *O. rufipogon* populations, cultivated rice (especially the photoperiod insensitive modern genotypes), and their hybrid progeny (Pusadee et al 2013; Wongtamee et al *in press*). This requires basic understanding of the highly dynamic and diverse *Oryza* gene pool, in order to anticipate potential threats, such as new herbicide resistant weedy rice populations.

GRiSP has also developed and improved a number of decision support tools for rice crop management. These included guidelines for sustainable rice production and enhanced input use efficiency, profitability and sustainability. Tools such as Rice Crop Manager, based on smart-phone technology, have reached various stages of validation and delivery in different countries in Asia and Africa. The most widespread adoption is in the Philippines, where the public extension system is using Rice Crop Manager, incorporating key elements such as climate information, target yields and varietal choice, and providing advice to tens of thousands of farmers.

Nonetheless, the effectiveness of these decision tools along the impact pathways has often been limited. For example, average benefits of SSNM (site-specific nutrient management) were positive in the Philippines, but could have been more effective if more attention were paid to the many instances (sites and seasons) where benefits were low or zero, even though average benefits were positive. There is still much to be done to develop appropriately rigorous methods to validate these tools and design a strategy for scaling up their use.

5.5.3 Adding value (T4)

Although value chain work has been underfunded, GRiSP promoted the importance of grain quality, post-harvest and storage technologies and consumer preferences. There has been more emphasis on increasing grain quality to meet consumers' demands by improving intrinsic quality of varieties and extrinsic quality of the final product (cleanliness, uniformity and packaging).

Research carried out by GRiSP and its partners has resulted in new impact pathways for responding to the growing market for high quality rice and the struggle for greater market share in domestic and export market. For example, experimental auction studies in Africa have shown that locally produced rice could compete with imported rice in urban markets if its extrinsic quality attributes are tailored through improved post-harvest handling to meet the preference of consumers (Demont, 2015).

Key intrinsic quality characteristics in the immensely diverse global rice market are now better defined (Calingacion et al 2014), so that tools for their assessment can be developed. Grain quality characteristics, such as grain length, width, chalkiness, protein content, amylose content, and gelatinization, have begun to be measured in some sets of genotypes under defined environment in Africa and Asia. The impact pathways to increase value with better quality are motivating genetic studies and gene discovery work, breeding and crop management, as well as post-harvest processing.

GRiSP has also made progress in promoting mechanization. These include business models for combine harvesting, laser levelling, drying and other post-harvest operations, which are now being adopted at some hubs. In several countries in Africa, there has been an appropriate push on mechanization through improved design, testing and demonstration of a range of equipment and machines.

There are indications that some of these products are contributing to the move along the impact pathways towards the IDOs. For example, in India, business models for open-drum and axial-flow threshers have been taken up by women's self-help groups, farmer groups and service providers. In collaboration with the private sector, a new low-cost solar bubble dryer was developed and tested to improve sun drying in Cambodia, Myanmar, the Philippines, Vietnam and Africa, and launched commercially in the Philippines. In Vietnam too, farmers praised the SFLF ('small farms, large field') campaign to enable them to realize economies of scale by working collectively with input suppliers, machinery service providers and rice buyers.

On the other hand, it is not clear how much of the upgrading of the post-harvest value chain in Asia (e.g. some 5,000 combine harvesters operating in Cambodia) reflect effectiveness of GRiSP and how much is driven by market forces and local innovation. While IRRI is the primary source of improved rice germplasm, the situation is quite different for rice post-harvest technology and mechanization. Machinery manufacturers and service providers with new business models of various scales are emerging and proliferating across Asia to provide services to farmers in the various tasks of growing rice, linking farmers to millers and tapping agribusiness investments for the sector. GRiSP needs a clearer strategy on how it is adding value to efforts by the private sector in mechanization and post-harvest research and technology transfer in such a dynamic market environment.

5.5.4 Social science and policy (T5 and T6)

GRiSP has a modest but quite effective effort in policy-related research. The rice crop information and modeling work is now delivering real time information on rice production and markets that is appreciated by public and private sector stakeholders. Likewise, GRiSP is providing data for policymaking, such as the support that AfricaRice provided in developing NRDS (National Rice Development Strategies) within the Coalition for African Rice Development (CARD) and for grouping countries according to the relative priorities of onfarm productivity enhancement and improved post-harvest operations (Demont, 2014).

The Team found good examples of social scientists working in multidisciplinary teams on technology design, adoption and targeting, and influencing the research and delivery in other Themes (e.g., RCT work on Sub1 rice, experimental auctions on quality traits, evaluation of SRI in Senegal, and site specific farming systems analysis in Vietnam). However, other studies are very descriptive and do not provide the necessary analytics for a program of the stature of GRiSP.

The disciplinary structure of GRiSP does not seem to be optimal for fostering true interdisciplinary work across Themes, although it may be appropriate for facilitating interaction across core partners. There are big gaps where the technical Themes have a large research and delivery program on the ground with little involvement of social scientists.

Social science also has a critical role in understanding trends in poverty and livelihoods to design and target interventions to address the poverty IDO. However, technologies are sometimes promoted heavily, without sufficient evidence of their efficacy and potential for poverty reduction. For example, recommendations to de-emphasize work on mechanical transplanting and DSR due to possible negative impacts on women (Paris et al, 2015) seem to be at variance with what the program is actually doing in India.

Recommendation 6: Opportunities, incentives and modalities should be created to increase interdisciplinary research, in order to deliver integrated solutions that are consistent with the IDOs on critical problems of major rice production systems, especially at the hubs and sites where GRiSP works.

5.6 Conclusion

In its first phase, GRiSP has been effective in establishing a strong global rice partnership. Much has been achieved in building collaboration among the core partners, but there is also a great deal of potential to deepen collaboration through research on globally important challenges in rice. The most urgent task is to integrate the IRRI and AfricaRice programs around a common rice science strategy in Eastern and Southern Africa.

GRiSP is generally on track toward achieving planned outputs and outcomes. This is most apparent in the Themes 1 and 2, where a trait discovery program for stress-prone environments is linked to revamped international breeding programs, and from there, to national breeding programs and seed systems. Still, progress in the GRiSP breeding programs needs to be closely monitored and in the case

of Africa, stronger breeding programs are needed to address the many different rice environments and multiple stresses in the region.

Research in other Themes is necessarily more site specific and the strategy for local adaptation and scaling out through partnership requires further development. Such a strategy will need to recognize the heterogeneity of socioeconomic and ecological contexts of farmers, the complexity of Genotype, Environment and Management (GxExM) interactions, the need to design interventions at the landscape level, and the appropriate role of post-harvest management and grain quality. Work at the value chain level has been limited to date, but is now mainstreamed into GRiSP strategic framework. Finally, GRiSP needs to strengthen upstream or exploratory research in these Themes to assure a promising technology pipeline in response to a rapidly changing climatic and economic environment.

6. Cross-cutting issues—partnership, capacity development and gender

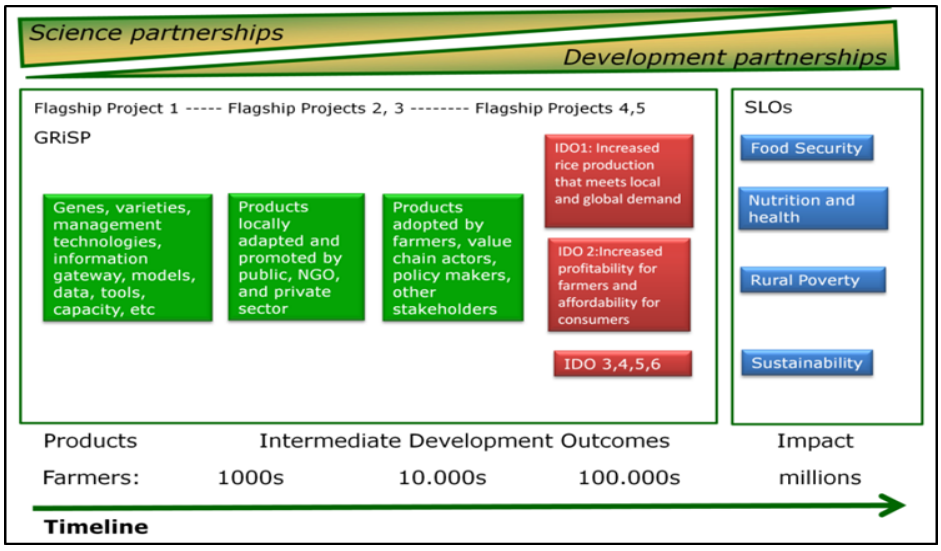
6.1 Introduction

This chapter reviews a number of cross-cutting issues that are essential for the effectiveness of the Program. GRiSP represent a big step to using partnerships as the primary mechanism for delivering international public goods through rice R&D. Central to partnership is the objective of CapDev especially for country partners, a role that was strongly re-affirmed in the original GRiSP proposal. Finally, GRiSP cannot expect to be effective nor equitable unless gender is mainstreamed throughout the GRiSP pipeline of activities. The Evaluation Team generated evidence for its assessment of these cross-cutting issues during its field visits, interviews and document review and used the researcher survey to complement other findings.

6.2 Partnership

Given the central role of partnership in GRiSP, reflected also in the name of the CRP, we review three types of partnerships—with ARIs, with other CRPs and CGIAR centers, and most importantly with national innovations systems. Within the GRiSP framework these partnerships span the range from upstream science partnerships on the left side of Figure 6-1 to research and development partnerships on the right hand side. In the researcher survey "engagement with most appropriate partners" was perceived as the best managed factor for enhancing effectiveness (30% rated it 6, well managed), and reflecting this, 47% of the respondent perceived that partners increased the effectiveness of research very much.

Figure 6-1 Diagram illustrating how GRiSP's partnership composition changes along the impact pathway

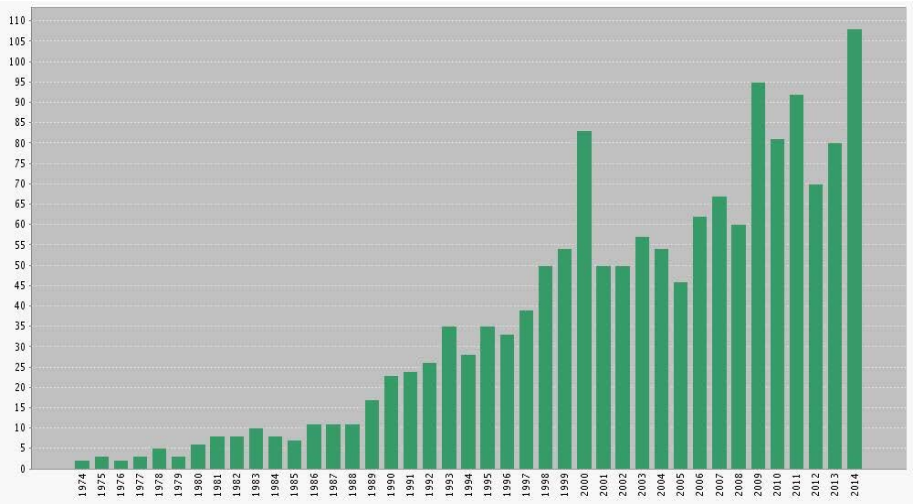


Source: GRiSP 2016 Extension Proposal

6.2.1 Partnership with Advanced Research Institutes

A major challenge for GRISP is to enable its core CGIAR centers to strategically position themselves in the global rice scientific community through partnership with ARIs. All three centers have always maintained a strong partnership with high profile research centers worldwide. This is evident in the rapidly increasing trend in joint publications in partnership with ARIs from the USA, Europe and Japan (Figure 6-2). [14] The Team considered whether joint publishing had increased after the establishment of GRiSP, acknowledging that the period is short given the expected lag from research initiation to publication. With GRISP there seems to have been peak in 2014 in collaborative publications between each of the three centers and ARIs.

Figure 6-2 Number of publications co-authored by CGIAR GRiSP scientists and ARI scientists for the 1974-2014 period



Source: ISI web of knowledge

With few exceptions, most GRISP partnerships with ARIs have been through bilateral projects. Just focusing on Theme 1, the C4 project is mobilizing a network of ARIs in the field of photosynthesis and physiology. The 3000 rice genome project did not start strictly speaking as a network-based project (rather a joint effort between IRRI and Beijing Genomics Institute in China). However, the ambition of IRRI in this project is to provide the rice scientific community with a highly valuable public good. IRIC was launched concomitantly with the publication of the 3000 genomes and could serve as one of the main nodes in the network of rice bio-informaticians (www.iric.irri.org). Through GRiSP this network and others like it could be more readily accessible to the other core partners of GRiSP. It is too early to state whether these efforts are a success.

Meanwhile there are other genomics networks where GRiSP is less central. The International Rice Functional Genomics Consortium that involves practically all the community involved in rice genomics research meets annually. IRRI is a member of the consortium but has no leadership role. The Plant and

[14] Note that all CIAT publications (regardless of crop or topic) were included in this survey and this may blur the situation with CIAT rice research.

Animal Genome conference gathers more than 2000 researchers every year in San Diego, USA. A rice functional genomics workshop has been held for many years during this conference. IRRI has not been involved in the organization of this workshop although the 3000 genome project was presented in the workshop in 2014. A positive development is that IRIC is now organizing its own workshop in the same conference. Finally, the iOMAP consortium, an international initiative for developing genomic resources for wild rice species does not include IRRI although its principle investigator is now associated with IRRI. The recent publication of the genome sequence of African rice (i.e. Wang et al., 2014) included one co-author from AfricaRice.

All of this suggests that GRiSP is involved in many partnerships and networks with ARIs, but its role in some is minimal and among the GRiSP centers IRRI is the one primarily involved. The advance in rice genomics represents a unique window of opportunity for GRiSP to engage a large and growing community of rice researchers in ARIs, at least for Theme 1.

Recommendation 7: The rapid acceleration of rice research worldwide over the past 15 years is an opportunity for GRISP to develop new partnerships with ARIs. GRISP should enrich its portfolio of new frontier and discovery research projects in partnership with ARIs with the objective of exploring new concepts and tools to achieve its goals.

A special category of ARIs are the advanced NARSs that are also important users of GRiSP products. Three such NARSs stand out—China, India and Brazil. GRiSP through IRRI has a detailed agreement with ICAR India that is tailored by Theme to the GRiSP program. The IRRI agreement with CAAS in China is very generic and predates GRiSP so there has been no concerted effort to engage CAAS at the highest level in contribution to GRiSP Themes. Finally, GRiSP does not have an explicit work agreement on rice research with EMBRAPA, the main public research body in Brazil.[15] Our interviews with these three NARSs indicated that they felt they could contribute substantially more to GRiSP through more intensive engagement from the program design stage. In some cases, especially in Themes 1 and 2, national laws and regulations may inhibit sharing of products and tools but other knowledge products should face no such limitations. All three advanced NARS have policies to share their expertise with Africa. In Chapter 8 the Team recommends that GRiSP further explore advanced NARSs as core partners.

6.2.2 Partnership across CRP and centers

Collaboration with CGIAR centers outside of GRiSP was strongest where the centers were jointly funded through bilateral projects. This was seen with MAIZE, WHEAT, Livestock and Fish, Aquatic Agricultural Systems, and Policies, Institutions and Markets in South Asia which are all funded by CSISA and where the centers involved share offices at the national, state and hub levels. GRiSP has smaller joint efforts with the Climate Change, Agriculture and Food Security CRP (CCAFS) and WLE in both Asia and Africa. Likewise SARD-SC (Support to Agricultural Research for Development of Strategic Crops in Africa) in Africa includes CRPs associated with AfricaRice, IITA and ICARDA. Even in these cases of joint

[15] As the Evaluation is being completed CIAT is now in a process of signing an agreement of cooperation with EMBRAPA.

bilateral projects, there are opportunities for improving collaboration, such as between PIM and GRiSP in South Asia—although the work programs are jointly discussed there is little evidence of real collaboration as indicated by a very low number of joint publications or adoption of findings of PIM work by GRiSP as observed by the Evaluation Team in the field visits.

In other cases, research programs related to rice housed in other CRPs are largely independent of GRiSP. A good example is the extensive work on rice policy, technology adoption and trade undertaken by PIM in West Africa. This may not be the fault of GRiSP nor PIM but represents a lack of incentives to collaborate. In the researcher survey, partnerships with CRPs are considered least important (Annex D); less than 50% of respondents considered them to have any importance at all. However, going forward, the Team suggests a much more proactive role of GRiSP in developing partnerships with PIM and other relevant CRPs, such as WLE.

6.2.3 Partnership with national innovation systems

GRiSP has over 900 partners and the great majority of these are partners from the countries that are the ultimate users of GRiSP products. These partners represent the full range from the traditional public sector partners of NARES, to private companies, farmer and industry organizations, and civil society. In the researchers' view (based on survey results), national research institutions are by far the most important partners followed by national governments, and these partners particularly enhance the relevance of research (Annex D). Researchers consider that partners are not only involved in conducting research (94%) but also in prioritizing research (74%).

Clearly given the number and complexity of national partners we cannot provide a comprehensive review of such partnerships and in any event many have already been discussed. Chapter 5 highlighted the extensive partnerships with seed companies for variety delivery and Box 6-1 summarizes African, mostly NARSs, perspectives on GRiSP.

Box 6-1 African stakeholder perspectives on GRiSP

The Team conducted 30 structured interviews with African partners by Skype or phone representing a range of national stakeholders and including 20 public NARSs. Interviewees overwhelmingly expressed their appreciation and support to GRiSP. The most important contributions of GRiSP were networking, access to knowledge and technologies, and above all capacity strengthening, especially for young professionals and women. Stakeholders broadly agreed that GRiSP had the right priorities and skill mix, although many mentioned the need for more engagement with the private sector for delivery of products, such as post-harvest. Financial support from GRiSP was also regarded as critical given the weak and unreliable funding of NARS in the region but still funds provided were considered insufficient for the range of activities implemented by the national Task Forces. For the future, African stakeholders would like even more involvement in GRiSP particularly CapDev. Even so, they would like to see a more equal partnership that engages them from the start in program design rather than acting as 'service providers'. Other players must also be taken into account especially the regional centers of excellence for rice research being established in Mali and Tanzania under the subregional research organizations with World Bank financing that involve the same NARS partners.

Rather our approach is to provide a simple typology of regional partnerships based on regional collective action. We then review four contrasting examples of these based on our field visits and interviews at the country level—Colombia, Vietnam, Nigeria and India. This leads to suggestions for GRiSP on how it might in the future better rationalize its partnership with national innovation systems.

Table 6- provides a simple typology of a selection of regional partnerships for GRiSP to engage in technology testing and delivery at the national level as well as facilitating regional networking among partners. The key elements in this typology are the type of membership, the size and sources of funding, and the governance structure. There are three broad models.

- Partnerships with a significant share of private members that are largely governed and financed by member contributions—the FLAR (the fund for irrigated rice in Latin America discussed in Chapter 3), HRDC, and the Sustainable Rice Platform (SRP) for developing and promoting certification standards. Members have a strong role in governance of these partnerships but the GRiSP centers generally coordinate them.

- Partnerships based largely on national public research systems and public universities although increasingly they include private and Civil Society Organization (CSO) participation at the country level—CORIGAP (Closing Rice Yield Gaps in Asia) - for irrigated rice in Southeast Asia), CURE (Consortium for Unfavorable Rice Environments for rainfed rice in South and Southeast Asia) and the AfricaRice Task Forces

- Partnerships based on large bilateral projects such as CSISA also regional in scope but largely driven by the CGIAR partners—IRRI, CIMMYT, World Fish and ILRI—and donor funding, that work with a diversity of partners at the country level.

During field visits we had the opportunity to interact with country stakeholders that are intimately involved in several of these partnerships.

In Latin America FLAR is the main rice research network and the Association of Rice Producers of Colombia, FEDEARROZ, is a founding member of FLAR. FEDEARROZ conducts nearly all rice research in the Colombia national program supported by a levy of 0.5% of production value paid by farmers, totalling nearly USD 4 million. FEDEARROZ with a technical staff of about 40 runs a small but effective research program that carries out breeding and adaptive agronomic research and some extension. The research program is approved by the governing board of FEDEARROZ made up of elected producers and industry representatives. FEDEARROZ in turn contributes USD 96,000 annually to FLAR that together with fees from about 30 other members runs a regional breeding program hosted by CIAT that benefits FEDEARROZ. CIAT focuses on upstream research that provides traits and other discoveries to the FLAR breeding program. CIAT also collaborates with FEDEARROZ in several of its upstream research projects so that it is contributes a small amount to the FEDEARROZ research budget. Overall, the Team saw this institutional mix as highly demand driven, mutually beneficial to all parties and the most sustainable model reviewed. The main risk is that FLAR depends on collective action that can breakdown especially since one member supports a large share of the FLAR budget. However, the Team views this risk as low given the 20-year track record of FLAR.

Work in the Mekong Delta, the rice bowl of Vietnam the world's second largest rice exporter, has been supported for decades, more recently under CORIGAP and before then, its predecessor, IRRC. Vietnam

is a good example of the successful use by IRRI to leverage national partnerships to link to delivery mechanisms at the sub-national level for integrated packages. The provincial governments in key rice provinces of the Delta, the Department of Agriculture and Rural Development (DARD) and often also rice milling and trading companies work closely with IRRI to implement large-scale extension programs such as the 'one must do, five reductions' and the 'small farm, large field' (SFLF) initiative described in Chapter 5. Much of this work is now being scaled up through an agreement with a World Bank funded project that requires farmer cooperatives to receive training as a prerequisite for financing of agricultural machinery and infrastructure. As a result, some 240,000 farmers implemented best practices over 300,000 ha (GRiSP 2014 Annual Report). CORIGAP and associated bilateral projects have incentivized new partnerships by national counterparts to deliver improved technologies. Evidence suggests that these partnerships are now locally-owned and reasonably sustainable. Nonetheless, IRRI financial support for operating costs, technical backstopping and the exchange of knowledge with other members of CORIGAP remains important.

Table 6-1 typology of a selection of regional partnerships for GRiSP to engage in technology testing and delivery

Network	Purpose/Method	Membership	Annual Budget and Source	Governance Structure	Role in Networking
FLAR (Fondo Latinoamericano para Arroz de Riego)	20-year-old public-private partnership affiliated with CIAT that funds a rice breeding program and network and some agronomic work.	30 members from 17 countries including public NARSs, seed companies and producer organizations	USD 1.5 M via member contributions	Administrative Committee comprised of a representative from each country and from CIAT that sets overall policy and the workplan. Executive Director contracted by CIAT to execute the plan.	Major mechanism for exchange of rice germplasm and related knowledge in Latin America
HRDC. Parallel HIALL consortium in Latin America for similar purpose closely linked to FLAR	Public-private partnership platform for research and dissemination of hybrid varieties.	A network of 76 members, 34 private and 42 public mostly from Asia but with 2 members from Africa.	Private member contributions (public members get free access)	Advisory Committee of five members (3 private) and IRRI sets overall policy and approves workplan. Coordinator from IRRI	Platform encourages sharing of germplasm and increased release of varieties
SRP	A partnership for extension, policy influence and "voluntary market transformation" to set sustainable rice production standards and design models to encourage adoption of standards.	Private companies (traders, food industry), research institutes, intern. NGOs, governments of Thailand and Vietnam (29 members)	Participants' financial or in-kind contribution	Advisory Committee represents core partners and two governments to advise on strategy/annual workplans. Secretariat hosted at UNEP Bangkok. IRRI is a joint convener with UNEP.	Focus to date has been on agreement on sustainability standards
CORIGAP (Previously the IRRC)	National partnerships to foster adaptive research, improved value chains and BMP within national programs and cross-country learning on GAP	6 countries from SE Asia and China represented by public sector NARSs and Universities	USD 2.3 M via IRRI (Bilateral)	Advisory Committee with a representative from each country, plus donor rep and IRRI. Coordinator from IRRI.	Important mechanisms for exchange of knowledge related to unfavorable environments
CURE	A "holistic systems approach" platform for NARS research partnership in unfavorable environments. Focused on testing/scaling out new varieties and new practices using farmer-participatory methods	28 Public sector NARSs and Universities from 10 countries in SE and Sth Asia	USD 0.68 M via IRRI (Bilateral)	Advised by a steering committee for program planning and budgeting, also overseeing an *ad hoc* technical advisory committee. NARS of partner countries engage with the CURE Steering Committee and Working Groups.	Important mechanisms for exchange of knowledge related to unfavorable environments

Network	Purpose/Method	Membership	Annual Budget and Source	Governance Structure	Role in Networking
AfricaRice Task Forces	Africa-wide collective R4D through 6 TFs: Breeding (26 countries); Agronomy (21) ; Processing & value adding (17); Policy (25); Gender & Rice R4D (17) and Mechanization (18) to test and extend new technologies, through the participating NARS aiming at harmonizing efforts across countries to reach a critical mass of researchers with NARS ownership.	Mostly public NARSs but with increasing participation from the private sector and CSOs	Varies by TF AfricaRice (Bilateral and W1/W2)	Participatory development of workplans and review of progress by members annually. Each TF coordinated by an AfricaRice Scientist with a President and Vice president from NARS[16]	One of the major mechanisms for exchange of germplasm and knowledge in the region.
CSISA	A partnership between IRRI, CIMMYT, IFPRI, WorldFish and ILRI, evolved from the former Rice-Wheat Consortium, to integrate research on cropping systems (plus livestock and fish systems) through extension of C/NRM best practices operating from rural "innovation hubs."	Works in three countries in S-Asia but no formal membership	About USD 10 M Bilateral via CIMMYT	National Advisory Committees. Overall coordination by CIMMYT.	Knowledge sharing in annual planning and review meetings
SARD-SC	Multinational CGIAR-led project to increase productivity and profitability of 4 strategic crops in Africa—cassava, maize, rice and wheat. Focus on capacity building and technology dissemination	20 countries in the region	USD 3.1 M Bilateral (AfDB) via IITA	Overall coordination by IITA	Knowledge sharing in annual planning and review meetings

[16] If the Chair person is Anglophone then the Vice Chair -person must be Francophone and vice-versa.

In Nigeria, AfricaRice works through the AfricaRice Task Forces that support work organized around 70 rice sector development hubs across 25 countries. The AfricaRice Task Forces (breeding, agronomy, post-harvest, gender, policy and mechanization) meet once a year at the regional level in a participatory review and planning meeting, followed by national meetings in Nigeria coordinated by the National Cereal Crops Research Institute. The Nigerian national program receives a small grant to implement the agreed TF program, focusing their efforts around hubs that may embrace one or two states where rice is a major crop. AfricaRice has a team in Nigeria supported in part by the Nigerian Agricultural Transformation Agency that provides technical backstopping and limited funding for work at the hubs. Research and development efforts at the hub level connect to many other partners—public extension, input suppliers, seed producers, processors, millers, and traders. AfricaRice is in the process of setting up multi-stakeholder innovation platforms at each hub to bring all of these players to the table to facilitate coordination along the rice value chain (Section 6.4). The overall approach is conceptually sound but it will take many years to establish a strong research and development program at each hub led by the national partners.

CSISA in India builds on a long legacy of CGIAR collaboration through the rice-wheat consortium in South Asia. Over time, the work in India has appropriately shifted to the poorer rainfed states of Eastern India and has greatly expanded with bilateral funding. In Odisha State, CSISA collaborates closely with numerous grass-roots development partners such as small private firms, service providers and NGOs to test and disseminate new varieties, production practices, post-harvest technologies, farm machinery and market information, and facilitates access to finance, contract farming, and other services. A hallmark of the work is that in an effort to demonstrate large short-term impacts, IRRI scientists aided by a considerable number of nationally recruited scientists and facilitators and with large amounts of donor funding (relative to the previous examples) are actively engaged in technology testing and delivery, often with little involvement of the traditional public research and extension partners. CSISA has a light governance structure with no overall regional steering group of stakeholders (as under the previous rice-wheat consortium) although this will change in 2016. National and hub advisory committees appear to be more for communication than program guidance. While we do not question the outstanding commitment and high quality of the IRRI scientists in CSISA, we do question whether this is an appropriate role for IRRI and whether the model is sustainable in terms of local institutional capacity after the project ends.

These examples represent a range of models of regional collaboration and national partnership. There are undoubtedly good reasons for the emergence of different models in each region but GRiSP could do more to rationalize the choice of model, evaluate them and share experiences across regions. FLAR clearly stands out as the model with the most ownership by national partners although we have noted some inherent risks in the model. CORIGAP is an excellent example of a mature regional partnership where national partners largely set the agenda and implement the program. However, it may be time to discuss moving from in kind contributions by national partners to cash contributions (following the FLAR example) to put the partnership on a more sustainable financial footing. The AfricaRice Task Forces and hubs are organized similarly to CORIGAP but working with weaker NARS at a much earlier stage of implementation they will require strong technical and financial backstopping from AfricaRice for many years. The Team's assessment is that this effort is seriously underfunded and it would be wise to focus on fewer hubs than currently envisaged. Finally CSISA is the most GRiSP/CGIAR driven of

the models with the centers clearly in charge and with relatively limited involvement of the traditional national partners (i.e., the NARSs) in funding and implementation--ironically this is happening in India one of the largest and strongest national systems. CSISA may be able to show short-term impacts (although this has not been demonstrated) but over the long term we do not see the impact pathway to local CapDev and sustainable impacts. The Team questions the decision of IRRI and the other centers to take on such large projects without a better defined long-term strategy.

6.3 Capacity development

The GRiSP 2010 proposal distinguished three aspects of CapDev, (i) enhancing global rice science capacity by building a new cadre of rice scientists, (ii) support for extension CapDev by developing a network of certified extension personnel closely linked to farmers and research, and (iii) capacity for inclusive participation within multi-stakeholder platforms. CapDev was to be largely managed within Theme 6 as part of efforts to promote large-scale adoption of new rice technologies and systems. While the GRiSP proposal placed heavy emphasis on individual CapDev, the respondent to the researcher survey perceived that institutional CapDev is also addressed. Over 60% of the respondents felt that CapDev is well or very well integrated to research (Annex D).

6.3.1 Global rice science capacity

GRiSP's involvement in CD includes formal academic degree programs and short-term training on specific topics. In 2014, GRiSP supported post-graduate degree training for 436 scholars, of which 186 were females. Many of these were supported through the GRiSS program initiated under GRiSP through W1/W2 funding. Many others were supported at the thesis level where GRiSP scientists provided supervision and/or financial support. A particular focus has been the need to train a new generation of plant breeders given that many young scientists have gravitated to molecular biology in the last 10-20 years leading a big gap in plant breeding capacity in many countries. In Africa, where NARS are smaller and often weaker, CD of NARS is one of the most successful contributions of GRiSP but even so most NARS struggle to retain high quality staff once trained. The cancellation of the GRiSS program due to funding cuts was a major setback.

GRiSP supported graduate training at a wide range of universities, many in the country or in the region and some internationally. In some cases, participation of GRiSP also aimed to upgrade quality of local graduate programs that are below international standards, as with the partnership with one university in India. On the other hand, many students had the opportunity to pursue degree programs in advanced universities, with funds from GRiSP as a full scholarship or for thesis research only. This has produced some high quality exploratory research such as research to understand the physiological basis of flood tolerance. More W1/W2 funding to enable GRiSP to be involved in graduate training would be highly effective in producing quality research while contributing to local CapDev.

GRiSP has also organized many opportunities for short-term training of scientists in national programs, in emerging areas of rice science. Much of this training is integrated into bilateral projects at the country or regional level. For example, from 1997-2013, IRRC in Southeast Asia had trained 20,782 partner staff on improved crop management technologies.

GRiSP does not appear to have explicitly built CapDev into its impact pathway but assumes that CD will occur as an integral part of each Theme in order to meet its outputs. To the extent that national systems vary in their capacity to conduct output delivery, this may constitute a risk that affects anticipated outcomes. In some cases, GRiSP has found ways to substitute for capacity weakness by extending its program downstream into adaptive research and delivery through large bilateral projects, as already seen. However, collaborative learning under the constraints and opportunities of the actual value chain in the real world with local delivery partners can and should be considered a valuable part of CapDev. The opportunity is missed when GRiSP directly takes on adaptive testing and delivery activities.

6.3.2 Extension capacity development

The Team found less evidence of extension CapDev. Good examples were found in the Mekong Delta and the Philippines that ultimately reached 7,000 professionals and the AfricaRice SMART-Valley program. IRRI and AfricaRice also organized in collaboration with the PhilRice a south-south exchange program for 142 extension and research specialists from Africa.

Much of the GRiSP reporting has been on the number of farmers reached. In 2014, GRiSP reports training of 93,000 farmers and other end users (such as rural entrepreneurs) through field demonstrations, farmer field schools, and other short-term events in 2013. These are extraordinary numbers, even when viewed in the context of the millions of rice farmers globally. However, without follow up analysis, the notion is tenuous that capacity is being built in the national system. What appears to be lacking from the set of CapDev activities is the original intention of building extension capacity to do the training and the establishment of a certification scheme for extension workers based on agreed standards of competence. To implement this activity GRiSP would need to work closely with development partners such as the World Bank and the multi-donor global program on Modernizing Extension and Advisory Services.

6.3.3 Inclusive participation in multi-stakeholder platforms

Multi-stakeholder innovation platforms that are being promoted in many local research-for-development sites offer one model for organizing inclusive participation at the hub level. In Asia, for example, the Learning Alliances in the Philippines, Vietnam, Cambodia and Myanmar now have five years' experience in setting the local research for development agenda. GRiSP is also building inclusive participation in multi-stakeholder platforms in Africa, although these efforts are still in their infancy. AfricaRice has recently hired an experienced staff member to provide facilitation and capacity building but functional platforms operate in only 6 countries namely Benin, Cote d'Ivoire, Ghana, Madagascar, Mali, and Uganda. These platforms offer an institutional mechanism at the hub level to set priorities, coordinate various stakeholder inputs, review progress and receive feedback on a regular basis. However, it is not clear how sustainable such approaches will be after the termination of project activities. Experience suggests that strengthening and making existing local organizations more inclusive may be the way forward.

6.3.4 From human resources to institutional capacity development

Our review shows that while GRiSP overall is strong on training at many levels, there is no coherent CapDev strategy that is premised on a broader definition of institutional CapDev to achieve sustainable outcomes. The impressive achievements in human resources CapDev may be eroded if they are not strategically targeted to fill critical skill bottlenecks or if trained human resources return to a poor institutional environment in which they are unable to use their newly acquired skills or they do not return at all. For this reason, the Team advocates a more strategic approach to CapDev that embraces wider issues of developing institutional capacity development.

Recommendation 8: In order to achieve sustainable outcomes from investments in institutional and human capacity development, GRiSP should support participating countries to develop long-term capacity building strategies and tailor GRiSP capacity building support to the priorities of those strategies.

6.4 Gender

Rice farming and value chains everywhere are changing rapidly with major implications for the role of women in decision making, labor specialization and post-harvest management. With appropriate technological and institutional support, rice farming could offer equal opportunity employment for women as well as men.

Working with the Consortium Office, GRiSP has articulated a gender strategy with specific goals and targets in all its Themes. The objective of the gender strategy is to ensure that gender issues are identified through rigorous gender analysis, with emphasis on (i) differential access to assets and technologies, (ii) technology impact assessment, (iii) empowering women farmers to remove gender inequities, and (iv) the involvement of women (at least 30% of the participating farmers) in adaptive research and dissemination along the whole rice value chain, as well as in capacity enhancement programs with a view to enhancing productivity and incomes. In the researcher survey, 67% of respondents were positive about communicating the gender strategy to researchers and teams, although only 40% confirmed (agreed or strongly agreed) that it had influenced the way research was conducted in the respondent's team. However, nearly 60% agreed or tended to agree that there was too much emphasis on gender (Annex D).

GRiSP through its W1/W2 funding has played a central role in sensitizing and training in gender analysis. For example, CIAT conducted its first analysis of the role of women in rice farming in tropical Latin America with support from GRiSP. Each center has appointed a GRiSP focal point on gender who works with international and national research partners with expertise on gender auditing, gender mainstreaming and strategic research on gender issues.

The Team overall assesses that GRiSP has been much more successful in mainstreaming gender downstream in the research and delivery pipeline than in incorporating gender as an integral part of research planning and technology design. As such gender is perceived more as an equity objective

than as a critical element for improving research effectiveness. The weakness of research on gender issues is a major limitation to better mainstreaming gender in research planning.

GRiSP appears to have successfully involved women as target beneficiaries in its activities for scaling out technologies despite cultural barriers that are imposed in some societies. The Team visited many field sites where an impressive share of participants were women. The following are some examples.

- Gender mainstreaming was apparent in Eastern India especially in the tribal areas where women often dominated farm decision making. We saw excellent examples of partnering with women's self-help and church groups to test and disseminate technology. Eighty per cent of adopters of the new seed processing and storage technology in Odisha were purportedly women. Extension training and capacity building activities have explicit numerical targets for including women. Consistent with Government of India guidelines, 30% of seed mini kits of STRVs went to women farmers. CapDev has extended to building women owned seed enterprises and in Bihar a group of women farmers became the very first agricultural service providers in India in 2014.

- In Africa, we saw excellent examples of empowering women to enter rice enterprises. In Senegal, the KhaarYallaGueyeGroup of women plays a lead role in rice processing, packaging and marketing in the Senegal River Valley that is successfully competing with imported rice from Asia. At a large traditional processing cluster in Nasawara State of Nigeria, both women and men had well defined roles in efforts to upgrade post-harvest management.

- CD activities have also explicitly targeted women. For example, by the end of 2014 GRiSP had provided opportunities for 186 female scientists for post-graduate degrees. Likewise, there are set targets for short-term training courses, workshops and conferences that have involved thousands of women. Extension training activities also involve large numbers of women. In Burundi, GRiSP managed a training course on rice production for 2,250 trainers out of which 400 were ex-combatant women

- Women are also involved in field research activities. In Africa, participatory varietal selection (PVS) involving women is routinely used to deliver elite lines as cultivars. In Southeast Asia, PVS showed differences in preferences between male and female farmer participants in four countries, Indonesia, Laos, Thailand and Vietnam (Manzanilla et al., 2014) and this has been followed by extensive PVS on STRVs in South Asia. Traits related to manual harvesting (plant height, lodging, threshing facility) and cooking quality were found to be important to women, since they are normally in charge of those tasks.

- Many adaptive crop management trials are carried out with women farmers or the involvement of female members of the household. Important research on consumer preferences in Africa has also largely involved women interviewees.

- Impact assessment work on NERICAs in Africa has explicitly incorporated gender with some studies showing women benefit more than men from their adoption.

Even so the Team found relatively few examples of careful planning of research that explicitly incorporated gender dimensions in the early stage of technology design. One reason for this is that GRiSP has conducted too little in-depth research on the role of women in rice farming and value chains. To be sure, household surveys regularly mainstream gender in terms of sample selection of female-headed households, and interviews are conducted with both male and female household members. These surveys have provided useful descriptions but not the hard analytics to better understand decision making with respect to labor, farm mechanization or marketing that are needed to inform technology design. As a result few gender specific issues have been raised regarding GRiSP's main products. In other cases, important implications from gender related-research may not be integrated into research design. For example, field surveys in Uttar Pradesh, India, noted that lower caste women may be losers from some technologies such as mechanical transplanting and recommended more emphasis on technologies for intensification and diversification, but it is not clear that this has influenced research priorities (Paris et al., 2015).

Without more attention to gender upstream in the research-delivery pipeline it is likely that much of the well-intended targeting in delivery will not succeed. Though the importance of gender seems to be accepted and recognized by GRiSP staff, particularly at management level, it still needs more attention across the whole spectrum of regions and steps along the impact pathway in order to achieve significant outcome and impact.

Recommendation 9: GRiSP should do more in-depth analysis to understand opportunities and constraints of women in rice farming and value chains in order to better address the effectiveness and equity impacts of its research and technology delivery.

7. Impacts

7.1 Introduction

Historically, impacts of CGIAR rice research have accounted for a large share of the total impacts on incomes and poverty reduction of investments in the system. This is partly due to the primary role of the crop in global food security and its importance for poor people, and partly because rice research, especially germplasm improvement, has been extraordinarily successful. Evenson and Gollin (2003) estimate that rice germplasm improvement accounted for a major share of total benefits of CGIAR investment in germplasm improvement over the period, 1965-2000. In a meta study of impacts of all types of CGIAR research for the period, 1970-1998, rice research still accounted for nearly half of all "plausibly" measured impacts (Raitzer and Kelley, 2008).

Impacts of rice research on poverty reduction and food security although less well documented are nonetheless impressive. Fan et al. (2003) demonstrated the strong poverty reducing impact of rice research in India and China, with IRRI contributing a significant share of those impacts. In Bangladesh, farm households that adopted modern varieties (based on IRRI) on over half their rice area achieved 58% of their rice consumption needs compared to only 34% for farmers with less than half of their area under MVs and adopters were also less vulnerable to drought.

These historical successes of investment in rice research are well known and are in large part a result of the Green Revolution breakthrough. The questions for this review is whether this success has continued in the post Green Revolution period, through continued gains in green revolution areas and through extension of those gains to the less favored and neglected areas such as East India and Africa, now targeted by GRiSP. In this section, we focus on impacts published during the evaluation period, 2011-15, that necessarily results from legacy research completed before 2011. Although the period assessed varies, the focus is in on impacts realized over the period since 2000.

Because the chapter largely draws on legacy research, the emphasis is on the accountability function of impact evaluation to assure stakeholders that the research is indeed meeting the agreed objectives, in this case as expressed in the IDOs and SLOs. However, we recognize that some of the early adoption and impact assessment has an important learning function by providing information that might be used to adjust the technology, the domain to which it is targeted, and the resources allocated to scaling up.

This chapter draws heavily on a synthesis paper on impacts of GRiSP prepared by Yamano et al., (2015) at the request of the IEA for this evaluation. The number of impact studies available from GRiSP centers was limited in scope and geography, except in Africa where there have been major efforts to assess impacts of the NERICA rice varieties. The studies also vary in rigor and many would not meet today's standards for impact evaluation. We note those cases where results need to be interpreted very cautiously.

7.2 Germplasm improvement

As in the past, the bulk of impact studies have focused on genetic improvement, realized through GRiSP's three breeding programs working through national breeding systems, mostly in the public sector (except in Latin America).[17]These breeding programs are situated in Theme 2 but draw heavily on advances in Theme 1. The counterfactual in these studies is that the GRiSP breeding programs did not exist although national programs would continue to make progress from their own research. The share of benefits attributed to the GRiSP breeding programs is based on the parentage of adopted varieties following now standard procedures.

In Asia, two significant studies of the economic impacts of genetic improvement have been undertaken under GRiSP, covering four of IRRI's major partner countries and reflecting results from IRRI's past investments in rice breeding (Table 7- 1). In addition to genetic gains in yield potential, the Raitzer et al. (2013) study includes also the impact achieved through breeding to reduce losses from diseases and insects. Both studies estimate a net present value of benefits from IRRI's research over the past 20-25 years exceeding USD 10 billion, a huge sum by any standard These results are very likely a substantial underestimate since the world's two major rice producers, India and China, were not been included.

Table 7- 1 Estimated Benefits from IRRI's research on Rice Genetic Improvement

	Brennan & Malabayabas(2011)	Raitzer et al. (2013)
Study Period	1985 - 2009 (25 years)	1990 - 2010 (21 years)
Adoption estimate	Expert opinion and surveys	Surveys
Benefit estimate	Economic surplus	Economic surplus
Source of benefits	Yield gain	Yield and HPR[a]gains
Discount rate	5%	5%
Country	NPV in 2009 USD million	NPV in 2005 PPP USD million
Indonesia	16,111	6,952
Philippines	5,088	1,114
Vietnam	15,378	n.a.
Bangladesh	n.a.	1,314

Note: [a] Host plant resistance (HPR).
Source: Brennan and Malabayabas (2011) and Raitzer et al. (2013)

Wide scale adoption studies in South Asia published under GRiSP suggest much more modest impacts in the more difficult environments of Eastern India, Bangladesh and Nepal. Although 121 varieties were released for these environments during 2000-10, 37% with at least one IRRI parent, adoption

[17]CIRAD also has breeding programs, largely focused on upland rice in Latin America (in collaboration with CIAT), and on temperate rice for the Madagascar highlands (in collaboration with AfricaRice).

has been modest (Table 7- 2). Most of the varieties were targeted on the irrigated areas (less than half of all rice area), and most of the rainfed areas were sown to a few mega varieties, such as Swarna and Pooja, released in the 1980s and 1990s. As a result the average age of varieties sown by farmers was over 20 years suggesting limited impact of investments in rice breeding in the past two decades.

These adoption data were collected just after initiating the wide scale distribution of the new STRVs, especially submergent tolerant varieties such as Swarna Sub1 in 2008. Although an impressive 390,000 t of seed of STRVs have been distributed to over 10 million farmers, this does not constitute adoption. A large survey of 9,000 households in 2014 in Eastern India and Bangladesh estimated that 1.4 million farmers had adopted STRVs on about 0.6 M ha (Yamano et al., 2015). However, there is growing evidence that final impacts will be much higher. A series of large-scale RCTs involving 1250 farmers in 128 villages has verified that under flood conditions such as in 2011, the submergent tolerant varieties provided a 45% yield advantage, with no yield penalty in nonflooded conditions (Dar et al., 2013). Even more importantly the RCTs demonstrated that poor farmers such as scheduled castes benefited the most since they tend to be located on flood prone land. Such strong results lend support to the decision by GRiSP and the government of India to accelerate the delivery of seed to millions of farmers with the added assurance that the varieties will self-target the poor.

Table 7- 2 Release and adoption of improved varieties in South Asia and Africa, circa 2010

	South Asia	Africa
Countries/states	India (Odisha, West Bengal, Chhattisgarh), Bangladesh, Nepal	Africa[c]
Total rice area (Mha)	26.6	9.70
Percent irrigated	48	26
FTE equivalent rice improvement scientists[a]	106	123
FTE rice breeders/Mt	1.18	9.0
Number of varieties released, 2001-10	121	83[b]
Number of varieties released, 2001-10 per Mha	4.5	10.2[a]
Percent of varieties with GRiSP parentage, 2001-10	37	77[a]
Percent area adopting of modern varieties	85	35

[a] Includes breeding and other disciplines such as pathology contributing to rice varietal development.
[b] Subset of 12 countries including the five largest producers.
[c] Burkina Faso, Cameroon, CAR, Cote dIvoire, DRC, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Madagascar, Nigeria, Rwanda, Senegal, Sierra Leone, Uganda.
Source: Calculated from Pandey et al., (2015), Diagne et al., (2015) and Wopereis et al. (2013)

Finally, a recent impact study in China (Shi and Hu, 2015) traced use of IRRI germplasm in adopted varieties in China. Although the role of IRRI has declined in China, in the most recent period, 2007-11 the area weighted share of varieties with IRRI parentage was about 10% and a higher IRRI share had a significant impact on farm yields.

Africa. AfricaRice has carried out extensive impact studies on the NERICA rice varieties that were developed through interspecific breeding between the high yield-potential Asian rice species (*Oryza sativa*) with African rice species (*O. glaberrima*) and selected using participatory varietal selection. NERICAs were first released in the late 1990s with high expectations that they would address the various stresses and resource constraints found in Africa, especially in the more difficult rainfed upland and lowland environments.

In a series of studies Diagne and colleagues at AfricaRice have found significant adoption of NERICA varieties with generally substantial impacts on income of poor households, although effects were quite variable as might be expected in heterogeneous rainfed environments. No overall impact study has been conducted but in 2008 the total areas cultivated of NERICAs was estimated at 652,620 ha in 18 countries, or about 8% of the total rice area (AfricaRice, 2015). In some cases, such as in Uganda, NERICAs have been dis-adopted (Kijima et al., 2011). Based on initial adoption results standardized for agro-ecological and socio-economic conditions, potential adoption and impacts have been estimated to be much higher if more farmers are exposed to the NERICAs and if they have access to seed. Although the NERICAs were an important achievement, it is fair to say that their impacts have not lived up to their early high expectations.

While much attention has focused on impacts of NERICAs, AfricaRice and IRRI based varieties have been widely adopted in the irrigated Sahel ecology. Basse (2015) showed that varieties released in the Senegal River Valley in 1994/1995 have been widely adopted (42% of area), significantly increasing yields (872kg/ha) and incomes (USD 227 per adopter), reducing poverty (19%-12%) and generating a net present value of benefits estimated at USD 25.6 million.

For all Africa, a comprehensive adoption study based on expert opinion and nationwide surveys has recently been published (Diagne et al., 2015) (Table 7- 2). During 2000-10, some 83 improved varieties were released in 11 countries, with 77% of them derived from research by the three CGIAR centers that constitute GRiSP. An estimated 37 % of the rice area in Africa was planted to modern rice varieties, with about half of that area planted to varieties directly released from the CGIAR centers or with center parents. However, the area under MVs in Africa does not seem to have increased since the last estimate in 1998 and as in Eastern India, the average age of varieties planted was a high 21 years. Notably, the research intensity—that is the number of full time equivalent scientists involved in varietal development per million tons of rice (Table 2) —is significantly higher in Africa than in South Asia, indicating the problems of building rice research capacity in many small and medium sized countries in Africa that are unable to achieve sufficient scale in rice science to achieve wide-scale impacts.

In tropical Latin America, expert opinion surveys in eight countries (Colombia, Peru, Bolivia, Ecuador, Venezuela, Costa Rica, Nicaragua, and Panama) estimated an overall adoption rate of 63% of the total rice area sown to CIAT-derived varieties (Labarta et al., 2014, Labarta et al., 2015a). This study estimated the economic returns attributable to CIAT rice genetic improvement program from 1995 to 2012 at around USD 314 million.

7.3 Other types of technologies

Addressing a big gap in impact research, GRiSP has made a commendable start on tracking the impacts of its substantial investment in crop and resource management research. The most comprehensive effort is by Rejesus et al. (2014) who reviewed the evidence of impacts under the IRRC in Southeast Asia. Because most sites in the IRRC lacked good baseline information on farmer practices to estimate a good counterfactual, the methods employed often do not meet the standards for rigor for impact evaluation. Nonetheless, the results do indicate significant economic benefits for most practices promoted through the IRRC; however, measured aggregate benefits are low in relation to the benefits of germplasm research in Table 1 above. Note however, that potential environmental benefits from improved crop and natural resources management, that could be expected, such as more efficient use of agro-chemicals, are not included in these estimates.

Table 7- 3 Research investments, benefits, and estimated economic surplus measures for individual IRRC-NRM technologies (across sites), 1997-2012

Technology	Total discounted benefits	Total discounted IRRC cost	NPV	Benefit Cost Ratio (BCR)
	Million USD	Million USD	Million USD	
AWD	14.2	2.1	12.1	6.7
Ecologically-based rodent management	5.1	1.7	3.4	3.0
Site-specific nutrient management	22.8	6.6	16.1	3.4
Direct seeded rice and short duration rice	6.5	1.7	4.7	3.8
Hermetic storage	0.5	1.0	-0.5	0.5
Reduced input use	14.0	n.a.	n.a.	n.a.
Integrated crop management	7.1	n.a.	n.a.	n.a.

Source: Table A1 in Rejesus et al (2014).

A number of other small-scale studies indicate positive economic benefits of crop management practices such as DSR, SSNM and AWD (Yamano et al., 2015). However, adoption numbers are generally low and in some cases such as DSR disadoption is significant (Yamano et al., 2015; Yamano et al., 2013). Similarly there are almost no studies of impacts of post-harvest technologies. Clearly, a challenge for GRiSP going forward is to invest more in rigorous tracking of adoption of CMR and value chain practices and applying broader measures of impacts, especially environmental benefits.

7.4 Conclusion

Legacy research of GRiSP has produced very large and wide scale economic impacts, especially through genetic improvement. Although the impact studies reviewed have big gaps, the benefits realized from GRiSP legacy research are in the tens of billions of dollars in Asia, and in the hundreds of millions of dollars in other regions. The largest documented impacts continue to be in favored areas. However, preliminary evidence provided by early adoption and impact studies of STRVs in South Asia and NERICAs in Africa suggests that this situation is changing and that future impacts of GRiSP investments could be realized on a large scale in less favored areas. Comprehensive RCTs and panel household data sets are feeding back evidence to support investment to scale up the adoption of STRVs and NERICAs through massive programs of seed dissemination and extension.

Evidence of impacts on investment in other thematic research areas, especially crop management research, is more fragmented and localized. GRiSP is to be commended for initiating impact assessment in this area including the development of appropriate methods, but much more work will be needed to show evidence of large and wide scale impacts towards the IDOs and SLOs that GRiSP targets, including impacts on nutrition, equity and the environment.

GRiSP still needs to develop a comprehensive system for assessing the **global impacts** of its investment in genetic improvement. To do this, it is imperative that it develop cost-effective and robust methods for tracking adoption of varieties in all the major rice producing countries, including all the major rice producing regions in India and China that use GRiSP germplasm and that have not been covered in recent impact assessments. This is important not only for GRiSP but also for the CGIAR as a whole, given the outsized role of rice in the total benefits of investing in the system. Fortunately methodological innovations in the form of mobile phone technology, DNA finger printing, adding questions to national panel data sets, and possibly satellite imagery, offer scope to do this in ways that meet minimum standards of precision at reasonable costs.

Impacts of crop and resource management research will need to use a two track approach—detailed GRiSP led local studies centered on hubs and partnership with national panel data sets such as the Living Standards Measurement Surveys of the World Bank or other national panel surveys. These national surveys offer prospect to track major changes in farming practices to assess impacts at the national level providing GRiSP works with them to define variables related to rice technologies. Partnerships with national panel household surveys offers a much more cost effective way to track changes in rice management technologies than large and complicated GRiSP-organized baseline surveys.

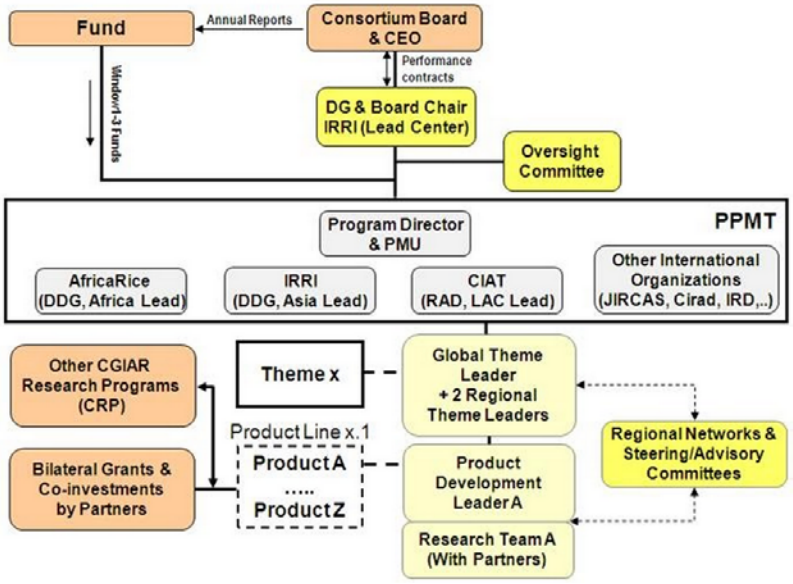
Recommendation 10: GRiSP with its national partners should institutionalize a systematic process of assessing its equity, nutrition and environmental impacts at a global level, especially for its germplasm, employing the latest tools and methods to achieve credible standards of rigor at reasonable costs.

8. Governance and management

8.1 Introduction

This chapter responds to the sixth overarching question of the Evaluation—To what extent do the governance and management structures and practices of GRiSP contribute to or impede the achievement of program coherence and effectiveness? GRiSP's governance and management structures involve its six core partners—IRRI, AfricaRice, CIAT, CIRAD, IRD and JIRCAS. Each of these partners is represented in the Oversight Committee and the PPMT (Figure 8- 1).

Figure 8- 1 GRiSP Governance and management [18]



The observations and analysis to address the overarching question are based on document review, meeting minutes, interviews with staff, Board and Oversight Committee members, surveys of Board and Oversight Committee members and staff, and attendance at AfricaRice Science Week 2015, and the Oversight Committee March 2015 meeting. The evaluation also considered other recent reviews, including the CGIAR Internal Audit Unit (IAU) internal audit of GRiSP in 2014-15, which includes an assessment of the program's governance and management[19], the Review of CGIAR Research Programs Governance and Management (IEA, 2014), and the response by the Consortium to this review. The Governance Review (IEA, 2014) rated GRiSP as a strong performer among CRPs, receiving a high rating for independence, participation and inclusiveness of governance.

[18] http://grisp.irri.org/oversight-planning-management

[19] The IEA and the Internal Audit Unit have signed a Memorandum of Understanding in which it was agreed that CRP evaluations would not include in-depth financial analysis.

8.2 The primary challenges of GRiSP governance and management

Since the many actors in GRiSP are independent of each other, configuring the relationships and accountabilities for effective governance and management requires considerable effort and commitment by the partners. Influence rather than command is the essential feature.The primary challenge for this complex and evolving partnership is to structure the relationships among the various independent actors in such a way that both preserves the autonomy and promotes the mutual accountability of the various partners. There is a formal contractual aspect to this, embodied in the system of cascading agreements from Fund Council through the Consortium, to the Lead Center, and the other core partners.

GRiSP governance and management also has to tackle an even more difficult practical problem of avoiding duplicative and overly complicated governance and management arrangements in such a multifaceted system. To avoid 'over-governance', and 'over-management' it will be necessary to sequence and structure the decision-making processes in such a way as to ensure good strategic oversight and high transparency, while keeping transaction costs in time and money as low as possible. In order to achieve the best results, trust-building among partners has been a high priority.

The idea of GRiSP predates the establishment of the CRPs, and is part of a larger process of alignment and harmonization of global rice research. GRiSP as it exists today represents a particular point on a long trajectory of transition toward a coordinated global effort in rice science. It is the aspiration of GRiSP leaders that GRiSP should expand its influence beyond the program activities financed and managed through GRiSP direct support (W1, W2 and W3), to offer a global coordinating framework for rice research more broadly. This will further increase the complexity of its governance and management.

The complex structure of GRiSP also presents challenges for managing potential conflicts of interest. Although this review focuses on the governance and management mechanisms of GRiSP itself, it is important to note that each of the participating centers and other partners in the program operates within its own governance and accountability ethos. This is a strong base to draw on for strategic scientific thinking and performance oversight, and a substantial benefit to GRiSP. However, it also means that research programs as well as individual scientists may be subject at various levels to the pressure of having 'two masters' – GRiSP and the center (or non-CGIAR partner), GRiSP and the bilateral donor, etc. This will be even more true as GRiSP attempts to expand its influence beyond the scope of GRiSP-financed activities.

As a general approach, GRiSP has applied a principle of subsidiarity in determining the appropriate roles of various levels and mechanisms of governance and management—that is, the primary decision-making should be as close to the site of activity as possible, with the higher levels focused on more comprehensive coordination functions and performing only those tasks which cannot be performed at the more immediate level.

8.3 GRiSP Governance

The primary governance mechanism of GRiSP is the OC, which is accountable to the Board of the lead center IRRI. Its purpose is to provide both strategic direction and oversight within the framework of the SRF and IDOs. Its composition encompasses disciplinary, regional and gender diversity. It also by constitution includes scientists who are independent of the participating centers, as well as scientists who are cross-appointed from the Boards of participating CGIAR centers, as well as representatives of the non-CGIAR core partners.

The Oversight Committee meets annually in person and through email as necessary, with some absences in early years. A review of the minutes and interviews with participants indicates that the role of the Oversight Committee has been the subject of continuous review and refinement, based on experience. The Oversight Committee has worked hard to define and develop best practices in program oversight and risk management. It will be important to continue to refine the Oversight Committee agenda and strengthen the engagement of the Oversight Committee members.

It is also envisaged in the IAU Report that for the Phase 2 CRPs the Consortium (or its successor) will develop a common CRP governance, risk and control framework to ensure consistent accountability and transparency across the system. This will be a positive development for the Oversight Committee.

8.3.1 Strategic direction

In establishing strategic direction for GRiSP, the Oversight Committee draws on its own disciplinary, regional, and gender balance of expertise. IRRI, AfricaRice and CIAT also have established a range of consultative mechanisms with national programs and other partners (Chapter 3), and these consultations feed into the OC. However, despite this attempt at broad inclusion, it has proven difficult to capture fully the perspective of all stakeholders, in particular of the strongest national programs such as China, Brazil and India (Chapter 3). In addition, because the role of the non-CGIAR core partners is evolving, their capacity to participate as key players in discussions of strategy is not yet fully mobilized. A number of stakeholders, especially from the non-CGIAR partners and the strong NARSs, noted that they were interested in being more engaged in strategic priority-setting for GRiSP, but were not sure how to do so.

That the prerogative of all Boards and governance bodies such as the Oversight Committee is to act in the best interests of the institution or program in question rather than to press the interests of the stakeholders is a paramount principle in the CGIAR system. For this reason, the CGIAR including GRiSP has always emphasized the importance of independent scientific advice. At certain points there is an inherent tension between the competing needs of stakeholder countries or institutions with the needs of GRiSP. The governance challenge here is to manage this tension – to structure the consultations so that all relevant voices are heard, without overwhelming the process either with sheer multiplicity of views, or with undue influence. The process should be transparent so that all interested parties can identify the most appropriate way to participate.

Recommendation 11: The Oversight Committee should define its processes of consultation for establishing global strategic priorities in rice research, and communicate this process widely to its stakeholders.

8.3.2 Program oversight

On matters of overall program oversight, the Oversight Committee's relationship to the Boards of IRRI, AfricaRice and CIAT is complicated by the fact that the Oversight Committee both reports to the Board of IRRI as lead center, and also depends on reports from the Program Committees of IRRI, AfricaRice and CIAT as primary inputs. The IRRI Board, and not the Oversight Committee, has the fiduciary role with respect to the Consortium, and well as the ultimate responsibility for GRiSP performance.[20]

In determining the most appropriate interaction between the Oversight Committee and the Boards of IRRI, AfricaRice and CIAT, the objective is to maximize the value-added from the Oversight Committee, rather than simply add layers of reporting. The Oversight Committee does not attempt to replicate the functions of the Program Committees (PCs) of IRRI, AfricaRice and CIAT Boards in assuring program implementation and scientific quality, but does retain responsibility to advise the Board of IRRI as lead center on these matters with respect to GRiSP as a whole. The GRiSP PD has suggested that 'scorecard' reports be submitted to Oversight Committee (signed off by the relevant Board PCs) through the cross-appointed Oversight Committee members for review by the Oversight Committee as a whole. Thus the center Boards including IRRI take appropriate responsibility for delivery of GRiSP program oversight, and then in a subsequent stage, the OC reports on overall progress to the Board of IRRI. The Oversight Committee also reviews the annual Program of Work and Budget (POWB) and the draft annual report submitted by the PD as part of its oversight. The question of timing and sequencing the various signoffs in such a way as to meet system deadlines requires the use of electronic signoff for the POWB. The Oversight Committee has noted the time and sequencing constraints of the current practice and has considered scheduling extra meetings as necessary to respond to the Second Call for CRP proposals.

The Team finds that this method of implementing the program oversight responsibilities of the Oversight Committee and center Boards is effective and efficient for the separate elements of the program. However, at the GRiSP level, the ability of the Oversight Committee to perform its oversight function would be enhanced by the capacity to enlist outside expertise on particular topics. At present external reviews of different program elements are commissioned and managed by individual centers, and focused only on the work of the center. It would be valuable for the Oversight Committee in consultation with the PCs of the Boards to initiate external reviews to examine the full GRiSP effort in a specific area (similar in concept to the CGIAR stripe reviews and as foreseen by the CGIAR Policy for Independent External Evaluation). This would allow the Oversight Committee to evaluate scientific quality, identify gaps or differences between program partner effectiveness, and advise remedial

[20] The IAU has noted that IRRI has a) applied risk management and control processes over GRiSP, b) separated the operations of GRiSP from day-to-day management of the Lead Center, and c) made best efforts to overseeing the CRP, and acknowledging ultimate responsibility for the CRP and its outcomes.

action when better coordination or a different organization of efforts is called for. [eg the East Africa 'problem' discussed in Chapter 5].

Recommendation 12: GRiSP level external reviews of particular areas of research should be commissioned by the Oversight Committee in consultation with the Board Program Committees and managed by the PMU.

8.4 GRiSP Management

The PPMT, comprising the GRiSP Director as chair, and senior managers from the six partners, is the primary locus of management oversight and accountability for the performance of GRiSP. The Program Director and a one-person Program Management Unit provide global leadership and coordination.

The objective of the GRiSP management system is to ensure that the resources at the disposal of the program produce the anticipated results in a timely and cost-effective way. Operating as a partnership, GRiSP has opted to emphasize mutual accountability and coordination over an attempt to establish a separate research management hierarchy. This is not merely a philosophical choice but an efficient one, given that the research programs of both IRRI and AfricaRice are significantly encompassed by the GRiSP umbrella.

8.4.1 Management of program implementation and delivery

On the ground, program management in GRiSP is delivered through the existing research management and administrative support systems of IRRI, AfricaRice and CIAT. Thus GRiSP scientists and teams are clearly lodged within the management and reporting systems of the centers, even in cases where a research activity involves more than one center. Because so much of GRiSP work is financed through W3 and bilateral funding, the tracking of progress and reporting against milestones and other results measures requires an elaborate system of matrix management, in which each center reports to donors for each of its bilateral projects at varying times and in different formats and levels of detail.

In a manner parallel to the relationship of the Oversight Committee to center Boards, the PPMT is organically connected to Center management through the membership of each center's DDG-Research on the PPMT. On the subsidiarity principle, the PPMT takes responsibility for a coherent overall program and focuses on the GRiSP-wide issues and coordination, while the centers individually take responsibility for program delivery along agreed lines. The PPMT reviews the allocation of W1-W2 funds by Theme and product line, designs and commissions the competitive process for New Frontier projects, and coordinates cross-cutting issues of gender, Monitoring, Learning and Evaluation (M,L&E), and science capacity building (GRiSS).

Across centers and partners, each Theme is led by a Theme Coordinator, with a budget for Theme coordination and planning. At present all Theme Coordinators are IRRI staff members, a reasonable starting point for implementing a complex new program. For the next phase, GRiSP management is considering distributing the coordination tasks, according to the availability of the appropriate skills at each of the core partners. The Team endorses this as a logical step forward.

Instead of attempting to replicate the controls and project management systems of the participating centers, the PMU relies on them. This raises the question of whether the PD has adequate capacity to manage for results. Both the CGIAR Governance and Management Review and the IAU Phase 1 Review of GRiSP stressed the importance of clarifying and guaranteeing this capacity. The Team concludes that through the organic links between the PPMT and the center management hierarchy, the PD and PPMT do have appropriate management powers. Within a matrix management system, the PD has influence on the performance appraisal of center PPMT members and Theme Coordinators. The entire GRiSP partnership portfolio is covered by project agreements, which are monitored for compliance and reported through center management structures, and overseen by Board Program Committees, coordinated at PD/PPMT and Oversight Committee levels. With an integrated M,L&E system (as suggested below), the PPMT will have a ready overview of program performance.

Given the need to maintain a delicate balance between coordination and control functions in GRiSP management, it will be helpful in the development in the next phase of GRiSP to re-specify TOR, expectations and limits of the PPMT and PMU in detail. This is also recommended by the IAU Phase 1 Review report.

8.4.2 Role of non-CGIAR core partners in management

The core GRiSP partnership includes JIRCAS, IRD and CIRAD, three institutions that are not CGIAR centers, but have an international research-for-development mandate. Their relationships are formalized in agreements with IRRI as lead center. As noted above, all three are represented on the Oversight Committee as well as on the PPMT. A number of scientists from JIRCAS, IRD and CIRAD are posted at the three CGIAR centers as an integral part of the GRiSP program, providing significant co-financing.[21] This innovative form of institutional partnership brings its own complexity in matters of coordination, mutual accountability, and shared responsibility.

In interviews, minutes and surveys it has been repeated that the role and potential role of non-CGIAR core partners is not fully satisfactory. All three would prefer to be more actively engaged and to provide more leadership, but at the same time not be burdened with management tasks that pertain only to CGIAR centers—a good part of the PPMT agenda.

The Team recognizes that the role of the non-CGIAR core partners in GRiSP management is still evolving. The Team affirms the value of expanding the scope of GRiSP core partners beyond CGIAR centers, and notes that the resources put at GRiSP's disposal by the non-CGIAR core partners have been appropriately recognized and integrated into GRiSP. Nonetheless it is not yet clear to what extent CIRAD, IRD and JIRCAS are in a position to be bound by the decisions made by Oversight Committee or PPMT, and whether their more active engagement in GRiSP would require such accountability. A further question for the future is whether the concept of core partnership should be rethought – for example, one form of core partnership could include strong NARS or other partners who have special interest and expertise in a particular Theme.

[21] Originally estimated at annual level of USD 28 million in 2010 although there has been no verification of what was actually delivered.

Recommendation 13: GRiSP should review and clarify the roles and expectations of its non-CGIAR partners (JIRCAS, IRD and CIRAD) in governance, management and research implementation. This review should also consider the desirability of expanding core partnerships for specific Themes, the criteria for doing so, and their role in management if included.

8.4.3 Monitoring, Learning and Evaluation

Monitoring, Learning and Evaluation systems are dealt with as a cross-cutting issue by the GRiSP PPMT. A shared framework allows improved planning and coordination among partners - it should serve an integrating function. MLE is incorporated as a critical element of the move toward results-based management, situating research objectives and results within a framework that explicitly establishes the connections from research activities through product development and intermediate development outcomes (IDOs) to impact.

MLE allows researchers to link IDOs, impact pathway analysis and a ToC, from a specific research activity to a global level of analysis. MLE systems enable improved program reporting by tracking against milestones and outcome analysis through large-scale data collection. MLE thereby allows scientists and managers to perform both routine monitoring and larger scale evaluation.

The Team found that GRiSP MLE systems are evolving quickly, but that the implementation is somewhat uneven. GRiSP has invested in MLE development in IRRI and AfricaRice, and GRiSP participates in the CGIAR Monitoring, Learning and Evaluation community of practice with other CRPs. At present, the specific MLE systems of IRRI, AfricaRice and CIAT are compatible but not integrated. It would be desirable to move toward a fully integrated MLE system across the core partners of GRiSP.

8.5 Financial management and sustainability

The establishment of the CRPs in 2010 as part of the CGIAR Reform process was intended to move the system to a new level of coordination and synergy. CRPs, GRiSP among them, were designed to improve the system's capacity to pull together the various resources at its disposal - centers, national and ARIs, universities, NGOS – in order to ensure a well-organized and efficient collective effort which would yield superior results on the ground. In order to reinforce this program and results focus, CGIAR level funding from donors was reoriented along CRP lines rather than allocated by center. W1/W1 funding was to the main vehicle for moving toward a CGIAR-wide program.

A key function of the PD and PPMT is to determine the allocation of W1/W2 funding within GRiSP. Although originally envisaged as a central, reliable source to guarantee stability and ongoing capacity to CRPs, the unreliability and shortfall of W1/W2 financing has forced it into a different role. As already noted in chapter 2 GRiSP W1/W2 was planned at a much higher level than delivered.

In the early years of the CRPs, the Consortium mandated CRPs to map most center programs to CRP categories and maintain historic levels of funding, as a trust building effort, and a measure to ease the transition from center-based to CRP-based CGIAR financing. In the case of GRiSP, the PPMT logically decided to extend this to formula funding allocation of W1/W2 funds across centers.

The PPMT agrees annually on levels of funding for central GRiSP functions – PMU, Theme coordination, Oversight Committee, New Frontier projects, and crosscutting issues (Gender, M,L&E, scholarships). The remaining W1/W2 funding is then allocated through agreed percentages to the three CGIAR centers for use in GRiSP strategic initiatives or as backfilling where bilateral projects do not fully cover agreed GRiSP product delivery (Chapter 3). W1/W2 funds are tracked to GRiSP Themes and product lines but the allocation process within centers is managed at the center level and reported to the PMU and PPMT.

New Frontier projects are one of the main mechanisms for GRiSP to initiate new research, allocating funds to the centers with the relevant expertise, incentivizing collaboration between the core partners, and engaging outside partners (Chapter 5). These projects, some competitive and some commissioned, are called, reviewed and selected by the PPMT as a means of supporting exploratory research in high priority areas of GRiSP at a global level. The Team considers that GRiSP performance would be enhanced by the allocation of a higher level of W1/W2 funds to collaborative exploratory research across the core partners and gradually reducing the amount allocated by formula funding.

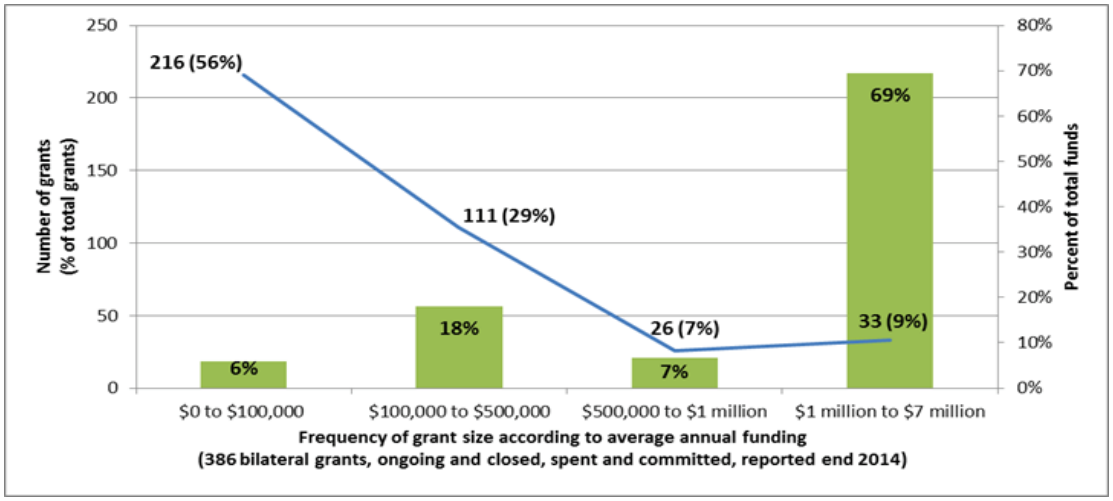
The CGIAR Reform and the establishment of the CRPs assumed that donors would provide a reliable and significant flow of relatively unencumbered financial resources through W1 and W2, to allow the CRPs to develop innovative partnerships and undertake new research such as the GRiSP New Frontier projects. The intention was that by the end of the CRP cycle, W1/W2 would account for as much as 80% of funding.[22] In practice, funding shortfalls and unanticipated budget cuts have imposed administrative and management burdens on GRiSP, and threaten GRiSP's sustainability. As currently foreseen, W1/W2 funding will probably represent only 25% of GRiSP funding in 2015[23], rather than 40% as previously envisaged.[24] W1/W2 funds have also been disbursed slowly and forecasts revised dramatically downward in 2014 and 2015, in an untimely way, with consequent impacts on planning and budgeting. The Consortium forecast for the 2016 W1/W2 budget is another cut of 35%.[25]

This funding context raises a number of serious issues with respect to the overall sustainability of GRiSP (and all CRPs for that matter). Substantial and reliable funding through W1/W2 is an essential element of the CRP model. A program which is heavily pre-encumbered by bilateral projects leaves less than optimal flexibility for new ventures across centers. The impact upon highly strategic elements of the GRiSP program is severe. In GRiSP, a second round of the GRiSS scholarship program have had to be suspended. Cross-cutting issues such as MLE development and gender strategy also become more vulnerable when W1/W2 funds are scarce. Without reliable long-term funding, the GRiSP centers cannot plan for maintenance and improvement of physical infrastructure and the program becomes over reliant on a few large bilateral projects, whose priorities may not be fully congruent with GRiSP (Chapter 3). Meanwhile, the time and energy spent in formulating and negotiating the multitude of small projects has a high opportunity cost (Figure 8- 2).

[22] Per GRiSP original proposal, as approved by the Fund Council 2010.
[23] Personal communication, Bas Bouman, September 2015.
[24] Program of Work and Budget 2015
[25] Personal communication, Bas Bouman, September 2015

Recommendation 14. The Consortium (W1) and the Fund Council (W2) should provide expanded and reliable core funding to GRiSP in order to take full advantage of the innovative scientific partnerships available for collaborative research, as envisaged in the SRF.

Figure 8- 2 Distribution of the number and amount of bilateral grants by size of grant (USD per year), GRiSP to the end of 2014



Source: Calculated from data on bilateral grants provided by GRiSP

8.6 Conclusion

GRiSP is well-governed and well-managed in a complex, challenging and changing institutional environment. By applying the principle of subsidiarity, GRiSP has kept governance and management costs at less than 4% of the total budget. The use of subsidiarity as a guiding principle in both governance and management design has helped to maximize both synergy and efficiency.

The Oversight Committee should articulate its processes for consultation on strategic priorities for GRiSP in order to ensure transparency and inclusiveness. Its oversight function could be strengthened by the addition of capacity to commission cross-GRiSP external reviews of particular research themes. The TOR of the PD and PPMT should be reviewed to ensure clarity about the evolving roles of individual partner institutions and the PMU, especially the roles of non-CGIAR core partners—both current and potential.

The most significant threat to GRiSP sustainability is the decline in W1/W2 funding and the unreliability of its delivery. If this can be reversed, GRiSP should move beyond formula funding and distribute more W1/W2 funds by competitive processes to foster collaborative research of global significance.

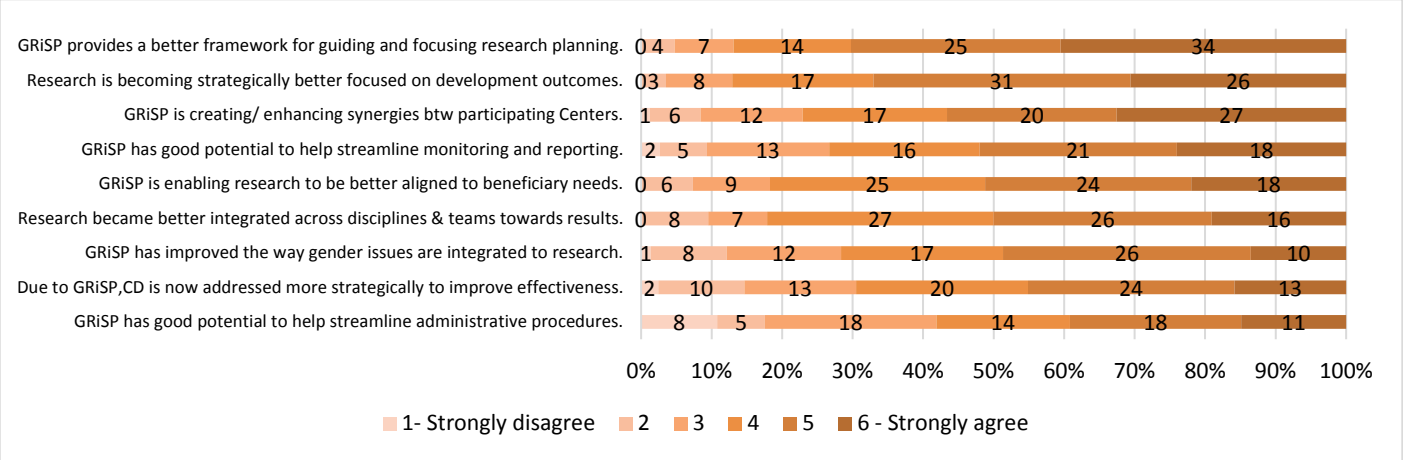
9. Value added and the future

9.1 Introduction

There is little doubt that GRiSP is providing considerable value added. This finding emerges consistently from the analyses in Chapters 3-8 of this evaluation. It is also felt strongly by the GRiSP scientists themselves where nearly three quarters agree that GRiSP provides a better framework for guiding and focusing research, and one third strongly agree (Figure 9- 1). It is also emerges from the answer to the seven overarching questions that have guided the gathering of evidence and the analysis of that evidence.

The answers to these questions below summarize our major conclusions with respect to the evaluation. The answers also highlight areas where GRiSP in the future could enhance its value added and impacts. These suggest three broad streams of action. First, GRiSP needs to build on the first phase to further deepen integration and collaboration. This should start in Eastern and Southern Africa but extend to greater efforts to build global collaboration through bottom up project design, and to enhance and tap specialization across core partners. Second, GRiSP needs to strike a better balance toward long-term exploratory research in partnership with ARIs while striving to leverage development partners for delivery and development activities. Third, in partnership with national systems GRiSP needs to pay more attention to local context and targeting, employing its considerable assets in spatial information data together with participatory but rigorous diagnosis and testing at the site level involving both natural and social scientists.

Figure 9- 1 Researcher survey responses on value added by GRiSP



9.2 Response to the overarching questions

a. What is the value added of GRiSP in facilitating synergies that can enhance the global benefits from CGIAR rice research to poor producers and consumers?

Overall GRiSP has succeeded in significantly increasing the interaction and synergies between the six core partners. The GRiSP proposal has served as the global framework for setting a shared agenda, thinking about impact pathways, and developing collaborative research on globally important challenges. Scientists at the CGIAR centers feel strong ownership of that framework and the GRiSP 'brand' is now being recognized by many partners in the global rice science community, but much less so by partners in the national systems. Under GRiSP, sharing of germplasm and knowledge and interaction among scientists across the three CGIAR centers has sharply increased especially in gene discovery and breeding. Interaction of centers with the core non-CGIAR partners—CIRAD, IRD and JIRCAS has also become more frequent and systematic under GRiSP although cross-posting of their scientists to centers has not increased nor has GRiSP funding for their research. The relative expertise of the different partners is now more widely recognized and being shared across regions, such as the Latin American expertise in direct seeded rice.

Even so, GRiSP is a work in progress and there is much potential to deepen collaboration and integration of research around globally important research topics. The non-CGIAR core partners do not yet feel fully at home in GRiSP and some strong NARSs would like to be more fully integrated. Evidence of increased research collaboration in the form of publications co-authored across the partners has yet to emerge. Finally, in Eastern and Southern Africa, the lack of collaboration and integration of AfricaRice and IRRI is a big missed opportunity for GRiSP that needs to be urgently rectified so that this region becomes a showcase for GRiSP collaboration.

b. Is GRiSP structure conducive to engaging ARIs to harness their knowledge and innovations to enhance the effectiveness of global rice research?

The structure of GRiSP by discipline has been conducive to interaction among core partners and with ARIs. Both the IRRI and AfricaRice structure mesh well with the structure of GRiSP and thereby facilitate interaction. IRRI, AfricaRice and CIAT have always had strong partnerships with ARIs but the impact of GRiSP in terms of number of co-publications will require more time to assess. Although not a structural issue, the Team assesses that there are missed opportunities to engage the substantial scientific resources in rice of India, Brazil and China in GRiSP. Finally, the structure of GRiSP largely along disciplinary lines has sometimes been at the expense of interdisciplinary research. This is most evident in the paucity of participatory diagnosis and adaptive testing by teams of natural and social scientists at the site level.

c. Are the partnerships with national innovation systems structured to enhance the capacity of those systems for sustained impact?

The Team found great diversity in partnerships with national innovation systems some of which were very conducive to enhanced capacity to sustain impacts—for example, our assessment of the CORIGAP partnership and Vietnam's capacity to continue much of its good work (Chapter 6). In Africa, partnerships are also well structured to enhance capacity through the Africa Task Force mechanism but sustained impact will require long-term support from GRiSP and increased investment by the countries themselves. In other cases, such as CSISA in South Asia we do not see the partnership giving sufficient attention to CapDev for sustained impacts through local organizations, and impacts achieved to date depend on continued infusion of resources via large bilateral projects. Overall, GRiSP has a

good range of institutional models for national partnerships that provides an opportunity for sharing experiences and evaluating performance and sustainability in order to better rationalize choice of models in the future.

d. Has GRiSP been successful in implementing an outcome and impact oriented culture and approach to research, while at the same time investing in long-term strategic science?

GRiSP has strongly emphasized results and impacts but this has sometimes taken it very downstream into technology delivery and extension where it does not have a comparative advantage. At the same time, there has been underinvestment in exploratory type research for long-term impacts, in some cases because bilateral projects aimed at short-term impacts have not provided the incentives nor resources for this type of research. Paradoxically, there has been under-investment in research to evaluate technology transfer models for achieving short-term impact. There has also been underinvestment in long-term strategic science in crop agronomy, pest management and social science. In addition, given the rapid advances in rice science globally since the mapping of the rice genome, GRiSP has a window of opportunity to substantially strengthen its upstream research in genomics and phenomics through partnerships with ARIs.

e. Does the GRiSP partnership elevate the quality of science among its partners while maintaining the relevance for GRiSP objectives?

Overall quality of science in GRiSP is good although uneven across centers and disciplines. However, there is little evidence that the GRiSP partnership has raised the quality of science. This is in part because it may be too soon to have reached the publication stage from the collaborative research, resulting in low co-authored publications across the partners. However, the New Frontier projects have promoted strong collaboration and the expectation is that this will raise the number of co-authored publications. Probably the most tangible collaboration that has raised overall quality has been in molecular breeding where QTLs are now quickly shared across the partners. The Team also found that collaboration with ARIs has continued under GRiSP and co-authorship with scientists at ARIs is common practice. Again we did not find evidence of increased collaboration with ARIs even though we see major opportunities for increasing that collaboration given the surge in rice science globally.

f. In the current complex funding environment, has GRiSP been able to manage multiple sources of funding to assure strategic coherence around highest priority areas of research?

Given the complexity of funding sources and the unreliability of W1/W2 funds, GRiSP should be congratulated for managing to implement nearly all of its original portfolio. Few of the original activities have been dropped although some such as the value chain work generally and the research for development hubs in Africa have been seriously underfunded. To accommodate cuts in W1/W2 funds GRiSP has not renewed the call for its New Frontier projects and its GRiSS, both deemed by the Team and by GRiSP partners to be highly effective and a high priority. Bilateral projects have also enabled GRiSP to make substantial progress in breeding for abiotic stresses. However, given the funding uncertainties, GRiSP has sometimes taken on large bilateral projects at the country level that have little research content and where its comparative advantage is not evident.

g. To what extent do the governance and management structures and practices of GRiSP contribute to or impede the achievement of program coherence and effectiveness?

GRiSP is well governed and managed in a complex environment. In most cases, application of the principle of subsidiarity to decentralize decision making and implementation to the centers is working well for reducing duplication and transaction costs. Governance practices could be improved at the level of the Oversight Committee by better communication with stakeholders about the processes for stakeholder input to strategic priority setting for GRiSP, and by the use of coordinated external evaluations of specific research themes across GRiSP. Management structures could be improved by distributing leadership across GRiSP according to expertise. Management practices could also be strengthened by integrating the monitoring, learning and evaluation systems across GRiSP, and by increased allocation of more W1/W2 resources to strategic research through competitive processes. Finally, governance and management structures are still evolving and could be improved by a review of the role of non-CGIAR core partners, both current and potential.

9.3 The future

Our review finds that GRiSP has made a strong start that promises to produce major impacts for the CGIAR objectives of poverty reduction, sustainability, and food security and nutrition. We also recognize that GRiSP is a work in progress and that many years will be needed to develop a truly integrative and collaborative global rice science partnership. This evaluation has recommended many areas where GRiSP could strengthen its relevance, effectiveness, and partnership to better realize its ambition. The Team notes that there is considerable congruency between several of our recommendations and changes to GRiSP recorded in the second round CRP pre-proposal on Rice Agri-Food Systems submitted to the Fund Council in August, 2015 suggesting that GRiSP has an effective process for learning and stakeholder input.

GRiSP has articulated a wider ambition of a global science partnership that would be broader than the CGIAR-based activities that are the core of the current GRiSP. Given the surge in rice science in ARIs and the feedback received by the Team from strong NARSs, such an aspiration is indeed appropriate. Nonetheless, we would urge caution in moving too fast, especially in a highly uncertain budget environment. Rather, the broader global partnership should be framed around a few high priority global challenges, perhaps scaling up successful ventures such as the New Frontier projects in phenomics and yield potential and the IRIC. In some cases, leadership of such global projects should pass to ARIs but with full involvement of the CGIAR in implementation.

Finally, and related to the last point, GRiSP has advanced considerably in establishing its brand name. Much more needs to be done to communicate this branding. While GRiSP conceptually applies to a broader vision of a rice science partnership, we see advantages to maintaining the GRiSP name even for the narrower CGIAR-centered partnership, and caution on the likely confusion from introducing a new acronym such as RAFS in the second round of the CRP.

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