CGIAR Advisory Services

# CGIAR Research Program 2020 Reviews: Rice Agri-Food Systems (RICE) Annexes

# Contents



**Find the Report and Brief here:**

CRP 2020 Review: RICE | CAS | CGIAR Advisory Services

# Annex 1: Terms of Reference for the CRP2020 Review, Addendum

Links to CRP 2020 Reviews TOR and Addendum[1].

## Annex 1.1: Call for Expressions of Interest

CRP 2020 Independent Reviews of Quality of Science and Effectiveness

Deliverables and consultation for the CRP Review (pag. 9–10 of the ToR attached)

The review team is expected to produce the following deliverables:

1. A preliminary findings matrix, for discussion midway through the review process, to check the progress of the review and to provide a basis for early course correction if required. The CAS Secretariat will provide the review team with a template for the Preliminary Findings matrix.
2. A brief presentation of preliminary findings, for the debrief with the CRP management and the CAS Secretariat for validation, factual corrections, and feedback.
3. A draft report of the CRP review, for review by the CRP management and the CAS Secretariat for final feedback. The CAS Secretariat will provide a template for the draft and final reports.
4. A final report of the CRP review, following the report template with a maximum of 20 pages, a 2-3-page executive summary, and a set of annexes with additional information apart from the main body of the report.
5. A PowerPoint presentation covering the main points of the review, including purpose, methods, findings, conclusions, recommendations, and additional notes relevant to the review. The CAS Secretariat will provide a template for this presentation.

Templates for the Preliminary Findings matrix, draft and final report, and the presentations will be provided to the review team in the first week of the review.

The review team will engage with the CAS Secretariat and the CRP under review at the following key points:

- Initial discussion with the CAS Secretariat to start the review and clarify questions from the review team.
- Briefing at the start of the review between the review team and CRP management, facilitated by the CAS Secretariat.
- Interview with the CRP Leader and a focus group discussion (FGD) with other members of the CRP management during data collection.
- Debrief presentation of the preliminary findings led by the review team, for validation, clarifications and feedback by the CRP management and the CAS Secretariat.
- The draft report will be shared with the CRP Leader and staff for factual correction and final feedback.

Additional discussions between the review team, the CRP management and the CAS Secretariat may be scheduled based as needed during the review.

[1] Accessed September 25, 2020

# Annex 1.2: Addendum to the Terms of Reference & Call for Expressions of Interest, June 2020

The CAS Secretariat has made the following modifications to the Terms of Reference (TOR) and Call for Expressions of Interest, for the CRP 2020 Reviews of Quality of Science (QoS) and Effectiveness.

Please note: (i) the independent reviewers for CRP reviews that will begin in August (see Annex I for the working schedule) will be selected by the first week of July, and (ii) the overall deadline is 15 July 2020 for submission of expressions of interest for the CRP 2020 Review.

**Methods.** The proposed surveys of CRP researchers, partners and donors have been removed from the CRP 2020 Reviews. The sample frame of respondents for these surveys was considered to be smaller than anticipated, thereby limiting the value of quantitative data collected from the surveys. Given the extensive qualitative methods (primarily key informant interviews) already applied to the same pool of respondents, the value of the surveys was determined to be questionable. Further, the burden on respondents was considered excessive, and a higher value is placed on the in-depth qualitative interviews. Considering the limited value addition of the proposed surveys and the burden on respondents, CAS has removed the surveys as a method for the reviews.

**Establishing contributions to Intermediate Development Outcomes (IDOs).** Links between the outcomes (documented as milestones) from the CRPs and the CGIAR Strategic Results Framework will be examined at the sub-IDO level, not the IDOs themselves.

**Data sources.** CRP performance data will be drawn from the Plans of Work and Budget (POWBs) and Annual Reports for the period under review, with supplementary information from the CGIAR result dashboard. The CAS Secretariat supports the reviews by integrating data from the dashboard, the CRP internal monitoring, and the POWB and annual reports, to allow the review team to make quantitative assessments of performance. The dashboard data will also be used in conducting a 'deep dive' of selected CRP outcomes (OICRs).

**Knowledge management.** The review team will be responsible for uploading and storing its original data, analysis, and drafts on the secure online content site (SharePoint) provided by the CAS Secretariat, as a basic step in knowledge management for the review.

**Analytics support.** The team will also need to adhere to timelines for accessing technical consultants made available by the CAS Secretariat, e.g., for quantitative analysis of performance data.

**Distribution of effort within team.** The two members of each review team (subject matter expert and senior evaluator) are each allocated 39 days for execution of the work, over the 11-week period. An additional two days are allocated to the team member who takes on the team leadership role. The team leader will also commit to responding to any questions or need for clarifications that arise from copy editing of the final report.

Further notes to interested consultants:

Consultants who have already submitted their expressions of interest have been logged in the CAS consultant database and do not need to re-submit their documents. Short-listed candidates will be contacted as preparations for the CRP reviews are made.

Consultants who wish to apply should indicate their expertise and availability in relation to the nine CRPs that are scheduled to be reviewed between August and December 2020. The reviews of three CRPs (A4NH, GLDC and Wheat) have already started.

***Table 1.1. Working schedule of CRP 2020 reviews***

| CGIAR Research Program (CRP) | Type | Review period |
|---|---|---|
| Grain, Legumes and Dryland Cereals (GLDC) | Agri-Food System | Apr-Jun |
| Wheat | Agri-Food System | Apr-Jun |
| Agriculture for Nutrition and Health (A4NH) | Global Integrated Program | Apr-Jun |
| Forests, Trees and Agroforestry (FTA) | Agri-Food System | Aug-Oct |
| Livestock | Agri-Food System | Aug-Oct |
| Climate Change, Agriculture and Food Security | Global Integrated Program | Aug-Oct |
| Fish | Agri-Food System | Sep-Nov |
| Maize | Agri-Food System | Sep-Nov |
| Water, Land and Ecosystems (WLE) | Global Integrated Program | Sep-Nov |
| Rice | Agri-Food System | Sep-Dec |
| Roots, Tubers and Bananas (RTB) | Agri-Food System | Sep-Dec |
| Policies, Institutions and Markets (PIM) | Global Integrated Program | Sep-Dec |

Note: this working schedule may be modified. When submitting an Expression of Interest, consultants are advised to indicate a range of dates for which they are available for conducting the reviews. The schedule for all 12 reviews spans April to December 2020, with an anticipated during of 11 weeks for each review. The final three reviews will begin in late September, to conclude by mid-December.

# Annex 2: RICE CRP Specific Methodology

## 2.1: CRP Review Questions

The overarching review questions are as follows:

1. To what extent does the CRP deliver Quality of Science, based on its work from 2017 through 2019?[2]
2. What outputs and outcomes have been achieved and what is the importance of those identified results?
3. To what extent is the CRP positioned to be effective in the future, seen from the perspectives of scientists and of the end users of agricultural research (such as policymakers, practitioners, or market actors)?

## 2.2: Overall Approach

The methodology employed mixed methods. As well as analysis of the theory of change, qualitative and quantitative data will be collected and combined in a process of triangulation in order to answer the three main review questions and all sub-questions, including additional review questions identified by RICE management (no additional questions were identified by RICE CRP team).

As well as review questions on the Quality of Science and Effectiveness, the analysis has estimated CRP potential up until the end of the CRP (2021), foreseen and unforeseen outcomes and impacts beyond program timeframes, and for the one CGIAR transition period.

The reviewers gathered and triangulated the evidence (qualitative, quantitative) to answer the three main review questions, using content analysis, interviews, and synthesis.

## 2.3: Assessing Quality of Science

Two key criteria are considered: Scientific Credibility and Legitimacy. These represent two of the four dimensions identified in the Quality of Research for Development Framework or Qo4RD (https://cas.cgiar.org/sites/default/files/pdf/ispc_brief_62_qord.pdf), which was provided by the ISPC in 2017, and updated in 2020. Key definitions are as follows:

**Scientific credibility** relates to robustness of research findings, dependability and soundness of evidence, accuracy of data, appropriateness of methods and clarity of presentation. This criterion recognizes the importance of good scientific practice, including peer review.

**Legitimacy** relates to the fairness and ethical nature of the research process, and the inclusiveness towards intended users, their interests and perspectives, implying trust, mutual commitment, "transparency, sound management of potential conflicts of interest, recognition of the responsibilities that go with public funding, genuine involvement of partners in co-design, and recognition of partners' contributions".

Both these dimensions of the Quality of Science are assessed by analyzing the following as achieved by RICE:

**Research inputs**, e.g. research staff, team compositions, availability of adequate research infrastructure and funding resources.

**Research processes**, e.g. incentives for achieving and maintaining the high scientific credibility of outputs.

Analyzing both inputs and process involved interviews with research managers, researchers (including early career researchers) and a wide variety of partners and stakeholders, to examine how research is designed, funded, managed and implemented to achieve scientific credibility and legitimacy, including equitable participation of women, youth and marginalized groups.

**Research outputs:** These were taken to include a wide variety of scientific outputs, notably peer-reviewed articles but also RICE papers, as well as outputs intended for policymakers, farmers,

[2] But accepting that some outcomes in the 2017–19 period are the result of research done in earlier years

extensionists etc. Following the *CRP 2020 Review Guidelines* these were taken to include: Software outputs such as guidelines and decision-support tools, training materials, policy briefs and other policy-change oriented actions.

A bibliometric analysis was conducted by the CAS Secretariat according to parameters set for all the current Independent Reviews and provided to the review team to enable assessment of the Quality of Science. This included citations of individual articles, impact factors of journals, h-indices of researchers, as well as Altmetric analysis of downloads etc.

Some assessment by the Subject Matter Specialist of individual outputs was conducted–those already highlighted in RICE Annual Reports. Criteria followed was as set out in the *CRP 2020 Review Guidelines*.

Analysis of Outcome Impact Case Reports (OICRs) is covered in more detail under "Effectiveness" below.

## 2.4: Assessing Effectiveness

Effectiveness of RICE is assessed in two ways:

- Assessment of planned versus completed outputs and outcomes as described in the annual POWBs and corresponding Annual Reports for 2017, 2018 and 2019. This included analysis of achievement or not of milestones which are used by CRPs to track progress by Flagship, year and level of risk as well as other metrics used by the CRPs and FPs, such as policies and innovations.
- Assess reported achievements with respect to the relevant theories of change (CRP and nested flagship ToCs). This analysis will assess the quality of the CRP (and Flagship) theories of change and achievements against those proposed pathways from outputs to a sequence of outcomes and impacts. We assembled the available evidence to test the plausibility of cause-effect linkages and the contribution of the CRP to development outcomes.

The analysis is guided by the OECD-DAC evaluation framework on effectiveness and to answer ToR Evaluation Question 2, we analyzed the strengths and weaknesses of the CRP and consider progress over time and according to resources available and management.

The assessment examined:

- The extent to which planned outputs and outcomes have been achieved by 2019 by carrying out a quantitative and qualitative assessment of the CRP (and FPs') progress according to their ToC
- The extent to which planned milestones have been achieved, extended, or cancelled by comparing the milestones identified in the annual POWBs and progress reported in annual reports or on MARLO for the three years under review.
- The number and level of maturity of "policies", "innovations" and "partnerships" as reported in MARLO and the Results Dashboard for the three years under review.
- The extent to which achieved outcomes contributed to broader goals and cross-cutting issues (capacity development, climate change, gender, youth and partnerships) by means of a 'deep dive' on a sample of OICRs, taking account of the predictability of funding and legacy time frame for the CRP.
- The extent to which the program's management and governance has supported the CRP's effectiveness.
- The extent to which the CRP and its Flagship Programs have made progress along their Theories of Change, including an assessment of the quality of those ToCs.

**Quantitative**

Data was collected from the Results Dashboard, and as supplied by the CAS Secretariat Technical Analyst. This data was analyzed, alongside programme documentation, including the annual reports, to assess effectiveness. The quantitative data will be triangulated with the qualitative data generated through stakeholder interviews.

Common Framework Indicators (CFIs) are being used in the CRP. CFIs of relevance to this review include milestones, policies, innovations and OICRs. Data was provided on all these indicators by the CAS Aata Analyst. The analysts supported analysis on deliverables, outcomes, and milestones by CRP, flagships, and timeframes (yearly).

**Qualitative**

Interviews: Stakeholder interviews (internal staff, partners, and other stakeholders) were conducted to generate evidence on effectiveness (achievements, delays, and adaptations etc.) and key lessons. It is important to note that for many interviewees these interviews covered Quality of Science (QoS) as well as effectiveness. Checklists were used to guide these interviews. The reviewers used the insights from the interviews to triangulate the information available from the quantitative data (e.g. reporting on milestones, policies, innovations and OICRs). This triangulation approach allowed the reviewers to better understand *how* and *why* effectiveness has been achieved or not, and to assess the relative contribution of the CRP.

A total of 42 interviews were conducted including RICE internal staff, partners, donors as listed in Annex 4. The interviews included (for those available during review period):

- CRP teams (PMU): CRP director, flagship leaders, CoA leaders, and others as applicable.
- IRRI and other centers (CIAT, CIRAD, AfricaRice): Research leaders, PPMT members.
- Stakeholders and research managers, from the CRP network of research centers including center representatives.
- Representatives of RICE partner organizations, including universities in the North and South, and national and international NGOs.
- National agriculture research systems (NARS).
- Donors, as per additional information from the Funder Analysis Dashboard.[3]
- Next-stage users, including from NGOs and the private sector.

**Outcome Impact Case Reports or OICRs** are produced by each CRP to report on key outcomes achieved, including Innovations at Level 3 and 4 and Policies at Levels 2 and 3. The CRP is responsible for writing new OICRs and updating existing ones (at same or higher level of maturity). Deep dive studies into existing OICRS will help the review team to better understand *how* the program is conducting research for development. The OICRs provide a means of testing the theory of change in different cases – cases selected to illustrate a type – in this case we suggest that the type is a project under each Flagship. A template has been provided to guide the analysis and ensure consistency and standardization, as well as documenting evidence. One such template will be filled per OICR.

As per the TOR, a minimum of two OICRs will be reviewed this way. Based on the criteria defined by the CAS Secretariat[4], 2 OICRs were selected. One template has been completed per OICR. Initially, we short-listed 10 OICRs, out of a database of 38 OICRs that we prepared from the OICR reports (for 2017, 2018 and 2019) provided by CAS. We finally selected 2 OICRs out of this shortlist provided in Table 1 below. The short-list is arrived at purposively to ensure a good coverage of the Flagships and LPs, the geographic regions, and levels of maturity.

[3] Donors channel funding to the CGIAR Trust Fund through three funding Windows: Window 1 (W1) - Portfolio investments: Not priority donors to interview because it is pool funding; Window 2 (W2) - Program investments: See the Funder Analysis Dashboard to identify the donors for which CAS can source the names of individuals to interview; Window 3 (W3) - Project investments: See also the dashboard for the Center that holds the grant to supply the name of the individual at donor to interview. Contacts for donors funding directly to specific projects in CGIAR Research Centers (Bilateral) can be sourced from the list of mapped projects to identify which donor behind the grants should be interviewed.

[4] High-impact cases to demonstrate effectiveness; different themes within a CRP; if new OICR, from 2019 to really grasp results from the three three-year period at stake in these reviews but preferable with maturity level 3; access to key informants in a timely manner must be foreseen; at least one where partnerships are significantly relevant; not being featured in the CRP annual report; relationship with CGIAR cross-cutting issues can be evidenced.

***Table 2. A shortlist of 10 significant OICRs and the two OICRs that were selected (highlighted in green)***

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 1 | 2018; updated 2019 | 2710 | Implementation of satellite-based rice monitoring system | 1 | South Asia; South East Asia | 2 | Enhanced institutional capacity of partner research organizations; Improved access to financial and other services | India, Philippines | State Department of Agriculture in Tamil Nadu, India; Philippine Department of Agriculture through the Philippine Rice Research Institute (PhilRice | Early insurance pay-outs surged during the recent Rabi cropping season in Tamil Nadu, a state in the south of India. For the first time in India, a state government made use of satellite data in assessing various damages and offered compensation to farmers under the prevented sowing feature of the national crop insurance programme. The satellite-based rice monitoring system, capable of collecting detailed and accurate data on rice production, will soon be operational in the state of Andhra Pradesh. | Several references and communication material cited |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 2 | 2018 | 2741 | Adoption of alternate wetting and drying in Asia | 3 | South Asia, South East Asia | 3 | Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use (Mitigation and adaptation achieved) | Thailand, Vietnam and Philippines | Ministry of Agriculture and Rural Cooperatives (Thailand); MARD - Ministry of Agriculture and Rural Development (Vietnam); PhilRice - Philippine Rice Research Institute; DA - Department of Agriculture (Philippines) | Alternate wetting and drying is a water saving technology that enables irrigated rice cultivation with less water than the conventional practice of maintaining the field continuously flooded. This technology can reduce water input and GHG without yield penalty. AWD has been integrated in major national rice crop management guidelines in Vietnam, China and the Philippines and dissemination has started in all countries above. Several rice-producing countries mention AWD in their contributions to the Paris Agreement. | Several references/publications cited; including communication material |
| 3 | 2018 | 2749 | Adoption of flood-tolerant rice varieties in Bangladesh (sub1) | 5, 1 | South Asia | 3 | Adoption of CGIAR materials with enhanced genetic gains | Bangladesh | BRRI - Bangladesh Rice Research Institute | In the flood-prone areas of Northern Bangladesh, adoption of flood-tolerant varieties decreased rice production damage by flood, thereby increasing profitability, ensuring food security and reducing poverty. | One reference/publication cited; communication material cited |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 4 | 2018 | 2750 | Adoption of '1 Must Do - 5 Reductions' rice management practices in Vietnam | 3 | South East Asia | 2 | Closed yield gaps through improved agronomic and animal husbandry practices | Vietnam | MARD - Ministry of Agriculture and Rural Development (Vietnam) | 1 Must 5 Reductions (1M5R) is certified by a Presidential decree (532-QD-TT-CLT) as the national policy to promote best management practices in lowland rice cultivation. In Vietnam, the use of 1M5R focused on reduction of seed and pesticide inputs. This management reduced the production costs by 23% reducing the production by 203 US$/ha per season, and generating 19% additional income, 175 US$/ha more. The adoption of this technology was 28% more beneficial compared to farmers who did not follow 1M5R. | One reference/publication cited; communication material cited |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 5 | 2019 | 2746 | Adoption of improved rice management practices in Southeast Asia | 3,2,1,5 | Global | 2 | Closed yield gaps through improved agronomic and animal husbandry practices | Indonesia; Myanmar (Burma); Thailand; Vietnam; China; Sri Lanka | MARD - Ministry of Agriculture and Rural Development (Vietnam); Ministry of Agriculture (Sri Lanka); ICRR - Indonesian Centre for Rice Research; South Sum. AIAT - South Sumatera Assessment Institute for Agricultural Technology; Ministry of Agriculture and Cooperatives (Thailand) | More than 600,000 farmers in China, Indonesia, Myanmar, Sri Lanka, Thailand, and Vietnam have been reached with a variety of improved management practice. These include 'single-technology' options such as improved water management (e.g. alternate wetting and drying), nutrient management (e.g. site-specific nutrient management), pest, rodent, and weed control, and including integrated crop management options. | Several references/publications cited: including communication material |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 6 | 2019 | 2842 | IRRI Rice Quality Assessment Kit commercialized and marketed globally | 2 | Global | 1 | Enhanced individual capacity in partner research organizations through training and exchange; Reduce pre- and post-harvest losses, including those caused by climate change | | GrainPro - GrainPro Inc | The IRRI Rice Quality Assessment Kit consists of a set of various tools that help measuring one or several paddy, milled rice, or seed quality traits. Target users are trainers, extension workers, farmers groups, traders, and millers. The quality kit was previously assembled and sold by IRRI but in 2019 was outsourced and is now sold by a private company (GrainPro Inc.). | One reference cited |
| 7 | 2019 | 3198 | Improved rice variety (WITA 9) was adopted by 24% of rice farmers and increase income by US$ 91 per ha in Cote d'Ivoire | 3,2,1,5 | West Africa | 3 | Adoption of CGIAR materials with enhanced genetic gains; Increased livelihood opportunities | Côte d'Ivoire | | A household survey showed that the adoption rate was 24% among rice farmers. However, closer analysis showed adoption rates of 60% among those who had heard about WITA 9, and 71% among those who had access to it. The adoption of WITA 9 variety paddy yield advantage was 0.7 t ha−1, and its adoption increased farmer's income by US$ 91 ha−1 per season. | Two references cited |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 8 | 2019 | 3263 | RICE and CCAFS contributed to restore a sustainable agri-food system in Vietnam through restructuring of the rice sector | 1,2,3,5 | South East Asia | 1 | Agricultural systems diversified and intensified in ways that protect soils and water; Increased capacity for innovations in partner research organizations; Increased capacity of partner organizations, as evidenced by rate of investments in agricultural research | Vietnam | MARD - Ministry of Agriculture and Rural Development (Vietnam); IPSARD - Institute of Policy and Strategy for Agriculture and Rural Development | By 2019, a few years after its issuance, the restructuring strategy has resulted in some positive impacts. Rice production started to develop in a more sustainable way with increasing proportion of fragrant and specialty rice. The large-scale rice fields model is expanding, and adoption of improved practices is higher. Rice production also shows higher efficiency thanks to the rearrangement of cropping calendar to reduce risks of natural disasters such as floods and salt intrusion. | Several references cited |

| S. No. | Year | No. | Title | Selection criterion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FP | Region | Maturity level | Sub-IDO | Countries of focus | Partners | Quantification summary | Quality of evidence |
| 9 | 2019 | 3274 | Coalition for African Rice Development (CARD) initiative contributes to increase production by 103% in Sub-Saharan Africa (SSA) | 1,2,3 | Sub-Saharan Africa | 3 | Closed yield gaps through improved agronomic and animal husbandry practices; Conducive agricultural policy environment | 23 countries | JICA -; JIRCAS - | Coalition for African Rice Development (CARD) was initiated with the aim to double rice production over the period 2008 to 2018. CARD was led by Japan with the support of many institutions including AfricaRice. After 10 years of implementation, we assessed the impact of CARD on rice production. CARD has contributed to increase production by 103% in 23 countries in Sub-Saharan Africa (SSA). | One reference cited |
| 10 | 2019 | 3277 | Rice Galaxy: an open resource for plant science published | 4 | Global | 1 | Adoption of CGIAR materials with enhanced genetic gains; Increase capacity of beneficiaries to adopt research outputs | | IRD -; CSU - Colorado State University; Texas A&M University; SCU - Southern Cross University; CIRAD - ; IU - Indiana University | Rice Galaxy (http://galaxy.irri.org) is a publicly available website for bioinformatic analyses using 3000 rice genomes sequenced from IRRI's rice genebank (3KRG project, https://gigascience.biomedcentral.com/articles/10.1186/2047-217X-3-7), Antenna Panel (rice genotypes that act as sensors for environmental changes, https://agritrop.cirad.fr/590501/) and other specialized datasets. Tools are available from the galaxy tool shed (http://galaxy toolshed.excellenceinbreeding.org) including for designing single-nucleotide polymorphism assays, analyzing genome-wide association studies, population diversity, rice–bacterial pathogen diagnostics, and a suite of published genomic prediction methods. | One reference cited |

This shortlist covers all FPs (including FP4, where we could only find one OICR at maturity level 1), plus the Gender and Social Inclusion Strategy, and all regions (all except Latin America). It includes four OICRs at maturity level 3; three OICRs at maturity level 2.

After analysis of relevant program documentation as listed in the OICR (which includes working documents by RICE and partners, peer-reviewed articles, in some cases government policy documents), the team conducted interviews with next-stage users to get new primary evidence.

## 2.5: Assessing Future Orientation

The likelihood of future progress is also assessed, related to:

- Extent to which there is a pipeline of innovations at the 'ready for take up' stage and policies influenced by sphere of influence.
- Reports of capacities developed, environment enabled, and key partnerships in place for development.
- Perspectives of research managers and partners.
- Extent to which management and governance of programme supports future effectiveness – presence of a learning environment, addressed and unaddressed challenges, integration across other CRP's work.

## 2.5: Analytical Approach and Methods

Specific analytical methods include content analysis of programme documents and interview notes. CAS analysts provided support to the review team by providing a statistical analysis which was later integrated with other data (qualitative and quantitative) to form findings on Quality of Science and on effectiveness. Theory based evaluation and contribution analysis methods was used to guide the assessment of effectiveness and to inform future orientation assessment. This involved assembling different types of evidence from diverse sources, triangulating this evidence, and testing the cause-effect linkages and assumptions of the theory of change to test contribution claims. The process was iterative and involved interviews/consultation with key stakeholders.

## 2.6: Limitations of the RICE CRP Review

This review was desk-based, involving analysis of program documentation and interviews with key stakeholders. It did not involve any travel to RICE institutions, field research sites or collaborating partners. The selection of two criteria, rather than the full set of CGIAR evaluation criteria[5], also means that the scope of the study is more limited than would normally be the case in a review of a program of this kind within a longer time-frame. The study focuses on accountability, which may limit its learning potential of, although the team has provided insights wherever feasible.

This review has relied on evidence mainly from the CGIAR Dashboard and CRP datasets; limited external assessment data was available from SPIA commissioned evaluations or project specific evaluations. A significant amount of data was extracted (by CAS pre-analyzed datasets) from the CGIAR MARLO system. Although non-CGIAR partners (CIRAD, IRD, JIRCAS) were progressively trained to use MARLO, it is likely that their contribution was only partially reported during 2017 and 2018.

The selection of OICRs, focusing on levels of maturity 3 and 2, means that the strongest outcome cases are being selected, with the classification stemming from the CGIAR MARLO system. The limited number of OICRs means that they cannot be representative of the overall program outcomes but can generate constructive lessons on how the CRP has worked at its highest level, which will also be useful for the one CGIAR process. See above for more information on the selection strategy for the OICRs.

Data across the RICE programme on outcomes appears to be limited in nature – there is quantification of the number of policies and innovations achieved and their stage of maturity, for example, and of milestones achieved by different flagships, but it is not analyzed by the RICE team on overall or flagship level theories of change. The review team have carried out this analysis though it was limited in nature due to limited data available to assess result-transitions, risks and assumptions and also enabling actions

[5] https://cas.cgiar.org/sites/default/files/pdf/CGIAR-Evaluation-Policy-Final-approved-document-effective-February-2012.pdf

undertaken by the CRP. We have all available datasets to review the ToCs. It is already noted by CAS that the milestones, OICRs, policies and innovation data do not always closely align to the TOC and datasets available are not sufficient to assessment ToCs in a robust manner.

The review has a relatively short time frame (28th September 2020 - 20th December 2020) for completion, which limits the number of interviews, for example, and overall scope of the study. Overall, this is a rapid review missing opportunity for in-depth data validation, field studies and wider coverage of key stakeholders across geographies and flagships.

Confirmation bias is a risk associated with review exercises of this kind. Within the resources available, the review team has aimed to interview a diversity of stakeholders and to consider their positionality in analyzing their responses.

The review was not an evaluation as focus is on two main aspects of OECD/DAC criteria of evaluation. Relevance, Efficiency, and Impact are not part of the purview of this review.

# Annex 3: List of Documents Reviewed

| Documents |
|---|
| CGIAR Research Program on Rice Agri-Food Systems (RICE), 2017 Annual Report. https://storage.googleapis.com/cgiarorg/2018/08/RICE-2017-Annual-Report.pdf |
| CGIAR Research Program on Rice Agri-Food Systems (RICE), 2018 Annual Report. https://cgspace.cgiar.org/bitstream/handle/10568/103688/01%20-%20RICE%20AR2018%20-%2025042019.pdf?sequence=1&isAllowed=y |
| CGIAR Research Program on Rice Agri-Food Systems (RICE), 2019 Annual Report. |
| Plan of Work and Budget 2017, 2018, 2019 |
| RICE presentation by the CRP Director (Bas Bouman); Flagship 1 presentation by Valerien Pede |
| RICE Full program proposal 2016 |
| RICE theory of change visuals http://ricecrp.org/theory-of-change/ http://ricecrp.org/flagship-projects/ |
| CGIAR Strategy and Results Framework 2016–2030. |
| ISPC Assessment of the RICE CRP revised proposal (2017-2022) |
| One CGIAR: A bold set of recommendations to the System Council. 13th – 14th November, 2019 |
| CGIAR Gender Platform https://www.cgiar.org/research/program-platform/cgiar-gender-platform/ |
| CGIAR Quality of Research for Development Frame (QoR4D) ISPC. (2017). *Quality of Research for Development in the CGIAR Context*, Brief N. 62. Rome: Independent Science and Partnership Council. https://cas.cgiar.org/isdc/publications/quality-research-development-cgiar-context |
| Evaluation of the first phase of rice – GriSP http://ricecrp.org/wp-content/uploads/2017/03/RICE-phase-I-evaluation-main-report.pdf |
| Management response to "Evaluation Report" of RICE. As captured by the annual reports in 2017. |
| Sustainable Rice Production – Performance Indicators 2.0 http://www.sustainablerice.org/Resources/#srp-standard |
| Direct Seeded Rice Consortium website - https://dsrc.irri.org/ |
| All references associated with the 2 selected OICRs for 'deep-dive' |
| A multiplicity of outputs reported in the Annual Reports and on MARLO |
| Cereal Systems Initiative for South Asia in India, Bangladesh and Nepal, funded by BMGF, and USAID, for Rice, Wheat and Maize https://csisa.org/annual-reports/ |
| CGIAR Research Program on Climate Change, Agriculture and Food Security (RICE) (2016–2024) |
| Carneiro, B., G. Resce, G. Ruscica, B.M. Yixin, G. Pacillo (2020) 'A web analytics approach to map the reach and influence of RICE'. RICE report. |
| IRRI, Audited Financial Statement 2019, http://books.irri.org/AR2019_audited-financial-statements.pdf |
| IRRI, Audited Financial Statement 2018, http://books.irri.org/AR2018_audited-financial-statements.pdf |
| IRRI, Audited Financial Statement 2017, http://books.irri.org/AR2017_audited-financial-statements.pdf |
| Unlocking the production potential of "polder communities" in coastal Bangladesh through improved resource use efficiency and diversified cropping systems, final report (2015-2019) by Kansas State University, IRRI, BRAC and partners |
| CGIAR dashboard, including financial dashboard, https://www.cgiar.org/dashboards/ |
| World Rice Statistics, http://ricestat.irri.org:8080/wrsv3/entrypoint.htm |
| OICR (satellite monitoring) deep-dive related documents reviewed: https://www.fastcompany.com/40456381/how-satellite-data-is-helping-drought-stricken-indian-farmers-collect-insurance-payouts; http://icrier.org/pdf/Working_Paper_352.pdf ; https://www.thehindu.com/news/national/tamil-nadu/most-tn-farmers-received-insurance-claims-under-centres-scheme-study/article23409354.ece |
| Terminal evaluation report, SMART-Valleys project 2014-2019, conducted by Dr. Mohammed Moro BURI, Chief Research Scientist, CSIR - Soil Research Institute (SRI), Kumasi, Ghana |

| Documents |
| --- |
| Minutes of RICE PPMT and ISC meetings, 2017, 2018 and 2019 |
| Standing Panel on Impact Assessment (SPIA) publications: What Is the Impact of NERICA Rice on Yields and Nutrition in Sierra Leone? Evidence from a Randomized Control Trial (May 2018), Brief number 69 and<br><br>From Green Revolution to Agricultural Transformation: The Case of Short Duration Rice Varieties in Bangladesh, Brief number 71 (September 2018) |

# Annex 4: List of Persons Interviewed

42 people have been interviewed from the RICE program, partners, donors, NGOs, private companies. Of these interviewees, 36 are men and 6 are women (14%).

| S No. | Name | Gender | Position (type of association with the CRP) | Contact |
|---|---|---|---|---|
| 1 | Bas Bouman | M | RICE CRP Director, IRRI (program team /PPMT) | b.bouman@irri.org |
| 2 | Ajay Kohli | M | Director for Research, IRRI (PPMT) | a.kohli@irri.org |
| 3 | Etienne Duveiller | M | DR4D, Africa Rice (PPMT) | e.duveiller@cgiar.org |
| 4 | Seiji Yanagihara | M | Senior researcher, JIRCAS (PPMT) | seijiy@affrc.go.jp |
| 5 | Didier Tharreau | M | Senior Scientist, CIRAD BIOS (PPMT) | tharreau@cirad.fr |
| 6 | Valerien Pede | M | FP1 Leader and Ag. Economist (program team) | v.pede@irri.org |
| 7 | Matty Demont | M | FP2 Leader and Sr. Scientist- Market Research and Value Chain (program team) | m.demont@irri.org |
| 8 | Kazuki Saito | M | FP3 Leader and Agronomist, Africa Rice (program team) | k.saito@cgiar.org |
| 9 | Camila Rebolledo | F | FP4 Leader and Molecular Biologist, CIAT/CIRAD (program team) | m.c.rebolledo@cgiar.org |
| 10 | Hans Bhardwaj | M | FP5 Leader and Global Lead, Rice Breeding, IRRI (program team) | h.bhardwaj@irri.org |
| 11 | Jean Balie | M | Research Director (External Engagement), IRRI, FP1 CoA 1 &4 (program team) | j.balie@irri.org |
| 12 | Ranjitha Puskur | F | Sr. Scientist, Gender, Livelihood, and Nutrition, FP1 CoA 2 (program team) | r.puskur@irri.org |
| 13 | Ricardo Oliva | M | Senior Scientist I - Plant Pathology and Host Plant Resistance, FP4 CoA 3 (program team) | r.oliva@irri.org |
| 14 | Ken McNally | M | Senior Scientist II - Rice Genomics, FP4 CoA 4 & 5; FP5 CoA 1 (program team) | k.mcnally@irri.org |
| 15 | John Platten | M | Senior Scientist I - Breeding Innovations, FP5 CoA 2 | j.platten@irri.org |
| 16 | Sankalp Bhosale | M | Senior Scientist I - Rice Breeding, FP5 CoA 3 (program team) | s.bhosale@irri.org |
| 17 | Shalabh Dixit | M | Senior Scientist I - Plant Breeding, FP5 CoA 4 (program team) | s.dixit@irri.org |
| 18 | Nese Sreenivasulu | M | Senior Scientist II - Grain Quality and Nutrition Center, FP5 CoA 5 (program team) | n.sreenivasulu@irri.org |
| 19 | Aminou Arouna | M | Program Leader and Impact Assessment Economist, FP1 CoAs 5 & 6 (program team) | a.arouna@cgiar.org |
| 20 | Prof. Dr. Lutful Hassan | M | Vice-Chancellor, Bangladesh Agricultural University (NARS/ program partner) | lutfulhassan@yahoo.co.uk |
| 21 | Dr. K.M. Iftekharuddaula | M | Head, Plant Breeding Division, Bangladesh Rice Research institute (NARS/program partner) | kiftekhar03@yahoo.com |

| S No. | Name | Gender | Position (type of association with the CRP) | Contact |
|---|---|---|---|---|
| 22 | Mr. Sudhir Nath | M | Business Director, ACI seeds, ACI Limited (Private Company/program partner) | sudhir.nath@aci-bd.com |
| 23 | Prof Vara Prasad | M | Director, Sustainable Intensification Innovation Lab, Kansas State University, USA (donor and program partner) | vara@ksu.edu |
| 24 | Tom de Bruin | M | Consultant (formerly Executive Director), GrainPro Philippines (private company/program partner) | tomdebruin62@gmail.com |
| 25 | Dr R K Sahu | M | Senior Scientist (Seed Division), ICAR-NRRI, Cuttack, India (NARS/program partner) | rabinksahu@yahoo.com |
| 26 | Dr. Tilak Raj Sharma | M | Deputy Director General (Crop Science) Indian Council of Agricultural Research, India (NARS/program partner) | ddgcs.icar@nic.in |
| 27 | Dr Voleti | | (NARS/program partner) | aks_gene@yahoo.com |
| g28 | Dr Sharat Kumar Pradhan | M | Director, NRRI, India (NARS/program partner) | director.nrri@icar.gov.in |
| 29 | Dr Ashok Kumar Singh | M | Director, IIRR, India (NARS/program partner) | director.iirr@icar.gov.in |
| 30 | Dr YP Singh | M | (NARS/program partner) | ypsingh.icar@nic.in |
| 31 | Rose Fiamohe | F | Associate Professor, University of Abomey-Calavi, Benin (NARS/program partner) | e.fiamohe@gmail.com |
| 32 | Yusuke Haneishi | M | General Coordinator, CARD Secretariat, Coalition for African Rice Development (CARD), Nairobi, Kenya (Platform /program partner) | YHaneishi@agra.org |
| 33 | Dr. Jimmy Lamo | M | Principal Research Officer/Rice Breeder, National Agricultural Research Organization (NARO), Uganda (NARS/program partner) | jlamoayo@gmail.com |
| 34 | Dorothy MALAA Kenyi | F | Agricultural Research Institute for Development (IRAD), Cameroon (gender and social science research) (NARS/program partner) | dorothymalaa@yahoo.co.uk |
| 35 | Jeffrey David Michler | M | Assistant Professor, University of Arizona, USA (program partner on impact assessment) | jdmichler@arizona.edu |
| 36 | Dr. Sellaperumal Pazhanivelan | M | TNAU, head of Remote Sensing and GIS, India (program partner) | pazhanivelans@gmail.com |
| 37 | Dr Alice G. Laborte | F | Spatial Analyst for Policy and Market Research Agri-food Policy Platform (program team) | a.g.laborte@irri.org |
| 38 | Dr. Michel Evéquoz | | SDC (donor) | michel.evequoz@eda.admin.ch |
| 39 | Humnath Bhandari | M | Bangladesh CO, IRRI, FP 1 COA leader (program partner) | h.bhandari@irri.org |
| 40 | Prakashan Chellattan Veettil | M | India CO, IRRI, FP 1 CoA leader (program partner) | pc.veettil@irri.org |
| 41 | Joe Tahme | M | CIAT Research Leader (program partner) | j.tohme@cgiar.org |
| 42 | Maria Fernanda Alvarez | F | RICE Leader at CIAT (program partner) | m.f.alvarez@cgiar.org |

# Annex 5: Data Collection Tools

Base questionnaire was developed and tailored to different interviewees/stakeholders:

1. **Overall impression of progress from CRP and its effectiveness:**
    a. Flagships – How have these evolved over time? How would you describe their progress and effectiveness?
    b. Cross cutting issues - How effectively are these issues being addressed within the RICE CRP?
        i. Gender - Please explain your perspectives on CRP performance in this regard
        ii. Capacity development - Please explain your perspectives on CRP performance
        iii. Youth - Please explain your perspectives on CRP performance in this regard.
    c. Main achievements and challenges of the flagship (and adaptations to challenges)?
    d. How does the flagship add value to the overall CRP and to discovery and development?
    e. Responses to earlier evaluations conducted after Phase 1 of the CRP? To what extent recommendations were acted upon?

2. **Overall impressions of progress from CRP on Quality of Science:**
    a. Steps taken to enhance quality of science during 2017–19
    b. To what extent periodic re-assessment of the demand, research work environment is carried out to inform current and future research?
    c. To what extent and how assessment of quality of research and its uptake by ultimate users of research is carried out?
    **d.** What is the value of scientific outputs in terms of developing capacities of researchers and next stage users? What more needs to be done towards collaboration with next stage users and beneficiaries?

3. **CRP and Flagship level Theory of Change (ToC):**
    a. What are your perspectives on the role of ToC in the RICE CRP program?
    b. How has use of the CRP/flagship level ToCs evolved over time?
    c. Which ToCs and impact pathways do you use? What are the strengths and weaknesses of the TOC from your perspective?

4. **OICRs:**
    a. How do you decide which OICRs to produce? (i.e. how do you define where your strongest impact is?) What are the most significant OICRs in the flagship?

    How OICRs tracked over a period of time? Whom we can reach out to conduct a 'deep dive' on most significant OICRs?

5. **Partnerships:**
    a. To what extent would you say that the CRP partnerships are effectively built and functioning on the basis of mutual understanding, trust, and commitment, with clear recognition of partners' perspectives, needs, roles and contribution?
    b. To what extent robust multi-stakeholder partnerships are achieved?
    c. How would you describe the interactions between the FPs and other CRPs?
    d. What challenges are faced in partnerships and how these were resolved or can be resolved?

6. **Future priorities/orientation:**
    a. Please describe the future priorities/areas of work that you think are most important?
    b. What, if anything, might you have done differently with hindsight? What key lessons can be learned to inform future research in the RICE Agri food systems?
    c. What are your perspectives on the One CGIAR transition and on future research modalities?
    d. Please describe the funding situation for RICE CRP over the period of study and also future funding scenario as can be visualized now? (reliability, leveraging etc.)

7. **Governance and management:**
    a. How effective management and governance has been? What has worked well? And what hasn't worked well or is not working?
    b. What changes you need introducing to overcome difficulties where things haven't worked that well?

# Annex 6: Bibliometrics and Altmetrics

| Criterion | Assessment approach |
|---|---|
| 1. Methodological rigor and coherence of data analysis | Rating scale<br><br>1 = Poor<br>2 = Mediocre<br>3 = Good<br>4 = Excellent |
| 2. Originality | Rating scale<br><br>0 = Not applicable<br>1 = No originality<br>2 = Standard methods, established knowledge<br>3 = Rather original<br>4 = Very original, new research, analytical or theoretical concept |
| 3. Referencing (whether referencing is up to date, balanced across relevant disciplines, indicating that the publication takes account of earlier work) | Rating scale<br><br>1= Referencing is poor<br>2= Referencing is limited<br>3= Referencing is good<br>4= Referencing is excellent |
| 4. Do the results (knowledge) presented in the paper represent broadly applicable knowledge (international public goods) relevant to agriculture and climate change? | Rating scale<br><br>0= Results not relevant to agriculture and climate change<br>1= No broader applicability (local relevance only)<br>2= Potentially broader applicability, but not spelled out<br>3= Broader applicability is presented<br>4= Significant international applicability |
| 5. Quality (and appropriateness) of publication venue | Observation of low-quality or inappropriate venue relative to subject and quality of paper |
| 6. Co-authorship | Observation of extent of co-authorship, with whom and is it appropriate? |
| 7. 7. Overall quality of publication (including additional criteria at evaluator discretion | Brief overall assessment (around 100-150 words) |

***Table 6.1. Assessment of the quality of ad hoc selected RICE research publications***

| FP | Journal article | Journal IF | Appropriateness of journal | Relevance | Originality | Rigor | Co-authorship | Overall quality summary |
|---|---|---|---|---|---|---|---|---|
| 1 | Impact of demographic transformation on future rice farming in Asia, Outlook on Agriculture, 47(2) 125-132 | 1.06 | 5 | 4 | 4 | 4 | Appropriate = 3 IRRI, Philippines, Arizona state Uni, USA. Authors using extensive data from multiple sources but including just 2 authors. Not giving credit to NARS participants | An extensive study that makes use of demographic transformation data from 17 major rice growing countries in Asia and draw conclusion on how these transformations will affect labor market, rice market, rice demand and rice supply. A very important paper for policymakers and scientists to manage future demographic transformations. |
| 1 | Determinants of success and intensity of livestock feed technologies use in Ethiopia: Evidence from a positive deviance perspective. Technological Forecasting and Social Change, 115: 15-25 | 5.84 | 5 | 1 | 3 | 2 | Appropriate= 3 Authors from IRRI, Addis Ababa, Ethiopia. | The paper focuses on the nature of technologies that influence feed technology. Study shows that when there is limited adoption, few pockets of success in improved technologies use, positive deviant approach would be more informative to understand the underlying factors and principles for success and intensified use of technologies than the most commonly reported conventional adoption rate studies. The work has no relevance to rice. |
| 2 | Development of an inflatable solar dryer for improved postharvest handling of paddy rice in humid climates *International J. Agric & Biol Eng. 10(3) 269-282* | 1.62 | 4 | 4 | 4 | 3 | Appropriate= 5 Authors from IRRI, GrainPRo Philippines, and Hohenheim Uni, Germany | Paper describes drying and storage method of paddy to reduce post-harvest loses. Methods of drying and storage with various calibrations are described which are important in reaching required moisture content for efficient storage and minimize post-harvest loses. |

| FP | Journal article | Journal IF | Appropriateness of journal | Relevance | Originality | Rigor | Co-authorship | Overall quality summary |
|---|---|---|---|---|---|---|---|---|
| 2 | Rice quality: How is it defined by consumers, industry, food scientists, and geneticists? Trends in Food Science and Technology | 11.07 | 5 | 5 | 4 (Review) | 4 | Appropriate= 5 Multiauthor paper, all form IRRI. A very useful concise information on the topic | Quality is a powerful engine in rice value chain upgrading. The review paper provides status of how rice quality is determined by various actors – consumers, industry, food scientists and geneticists. All relevant info on the subject is meticulously collected, presented, and discussed. |
| 3 | Site-specific nutrient management enhances sink size, a major yield constraint in rainfed lowland rice *Field Crops Research: 224: 76-79* | 4.31 | 5 | 4 | 4 | 4 | Appropriate= 5 IRRI, Philippines, Rothamsted Research, UK, PhilRice and ISAS, Japan. Authors giving due credit to Both international center, ARI and the NARS – Phil-rice. | The paper compared aboveground biomass and yield components of rainfed lowland rice under site-specific nutrient management and farmer management from 69 demonstration sites prone to mild to moderate intermittent drought across 9 Philippine provinces over 3 years (the 2011–2013 wet seasons). An extensive and rigorous study which establishes the role target nutrient management under rainfed lowland rice in relatively fertile and recommend fertilizer does to secure to increase panicle number and sizes. |
| 1,3 | Good agricultural practices, farm performance, and input usage by smallholders: Empirical evidence from Nepal. Agribusiness, Vol. 35 (3): | 1.22 | 4 | 4 | 3 | 4 | Appropriate= 3 A collaborative work between IRRI, Uni of Arizona and Uni of Central Missouri. All three organizations are well credited in the publication. Including NARS from Nepal is missing. | This study examines the impact of good agricultural practices (GAP) on the farm income and fertilizer usage of smallholders in Nepal. A novel study, as no study on adoption of GAP and its impact on income and fertilizer usage has been conducted, prior to this, in Nepal's small holder household setting. Appropriate rigor been applied in generating the data and conclusions made. Relevance of the study is high. |

| FP | Journal article | Journal IF | Appropriateness of journal | Relevance | Originality | Rigor | Co-authorship | Overall quality summary |
|---|---|---|---|---|---|---|---|---|
| 4 | Root cone angle is enlarged in docs1 LRR-RLK mutants in rice. Rice: 10:50 | | 4 | 4 | 3 | 3 | Appropriate= 5 Authors from IRRI, Philippines, CIRAD, Uni Montpellier. | Paper describes loss of function mutation in the DOCS1 gene using the CRISP-Cas9 technology. Results suggest that DOCS1 could also play a role in root cap development. The paper hypothesized these docs1 root phenotypes may affect gravity responses. They demonstrate the early gravitropic response was delayed due to this mutation. Furthermore, at adult stage, the root gravitropic set angle of docs1 mutants was also affected since docs1 mutant plants displayed larger root cone angles. |
| 4 | ALUMINUM RESISTANCE TRANSCRIPTION FACTOR 1 (ART1) contributes to natural variation in aluminium resistance in diverse genetic backgrounds of rice (O. sativa); Plant Direct, 2017; 00:1-19 | 1.72 | 5 | 4 | 3 | 4 | Appropriate= 4 Authors from Cornell, USA only. Lacks partners but they not needed for developing practical work | Paper highlight examples where putatively functional variation in cis-regulatory regions of ART1-regulated genes interacts with ART1 to determine gene expression in response to Al. This ART1–promoter interaction may be associated with transgressive variation for Al resistance in the Azucena 9 IR64 population. These results illustrate how ART1 interacts with the genetic background to contribute to quantitative phenotypic variations in rice Al resistance. |
| 5 | Haplotype analysis of key genes governing grain yield and quality traits across 3K RG panel reveals scope for the development of tailor-made rice with enhanced genetic gains Plant Biotechnology Journal, 17(8): 1612-1622 | 6.31 | 5 | 4 | 4 | 4 | Appropriate= 5 Authors from IRRI, India, IRRI, Philippines, ICRISAT, India, | Paper is highly original as identifies haplotypes for 120 previously identified functionally characterized genes influencing grain yield and quality in rice. Haplotypes analysis explained possible genetic basis of superiority of selected mega varieties in rice. Results of the study pave way for developing next generation tailormade rice varieties with superior haplotype combinations of target genes leading to enhanced food and nutrition security in rive growing regions. |

| FP | Journal article | Journal IF | Appropriateness of journal | Relevance | Originality | Rigor | Co-authorship | Overall quality summary |
|---|---|---|---|---|---|---|---|---|
| 1, 5 | Contribution of improved rice varieties to poverty reduction and food security in sub-Saharan Africa. Global Food Security, 14: 54-60 | 6.03 | 5 | 5 | 3 | 4 | Appropriate= 5 Authors from Africa Rice Bouake, Africa Rice Benin, The World Vegetable Centre, Taiwan, Africa Rice Centre Cote d'Ivore | Paper describes positive impact of improved rice varieties developed by IRRI on enhanced food security and poverty reduction. It takes into account data generated over 14 years of adoption of improved rice varieties and describe impact these varieties making on lives of poor farmers across SSA. |

### *Table 6.2. Budgetary figures of RICE across its 3 CGIAR partners*

| Centers | 2017 | | | | 2018 | | | | 2019 | | | | 2017–19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | W1W2 | W3 | Bilateral | Total | W1W2 | W3 | Bilateral | Total | W1W2 | W3 | Bilateral | Total | Grand total |
| Africa Rice | 3,306,473 | 3,367,616 | 9,744,125 | **16,418,214** | 3,357,899 | 4,128,155 | 6,236,688 | **13,722,742** | 2,848,007 | 6,413,377 | 5,800,758 | **15,062,142** | **45,203,098** |
| CIAT | 1,443,917 | - | 628,113 | **2,072,030** | 1,466,375 | - | 1,799,017 | **3,265,392** | 1,243,708 | - | 1,589,479 | **2,833,187** | **8,170,609** |
| IRRI | 10,450,585 | 14,189,532 | 27,966,840 | **52,606,956** | 9,972,763 | 20,583,254 | 30,712,014 | **61,268,032** | 8,592,137 | 15,416,550 | 36,246,774 | **60,255,461** | **174,130,449** |
| CIRAD | 410,007 | | | **410,007** | 416,383 | | | **416,383** | 353,156 | | | **353,156** | **1,179,546** |
| IRD | 293,673 | | | **293,673** | 298,240 | | | **298,240** | 252,953 | | | **252,953** | **844,866** |
| JIRCAS | 234,087 | | | **234,087** | 237,728 | | | **237,728** | 201,629 | | | **201,629** | **673,444** |
| | **16,138,742** | **17,557,148** | **38,339,078** | **72,034,967** | **15,749,389** | **24,711,410** | **38,747,718** | **79,208,517** | **13,491,590** | **21,829,927** | **43,637,011** | **78,958,528** | **230,202,012** |

***Table 6.3. Top 15 choice of journals for the CRP RICE publications***

| Sources | Articles 2017–19 | Impact factor 2019 | JCR category | Rank | Quartile in category | Open access |
|---|---|---|---|---|---|---|
| Field Crops Research | 49 | 4.31 | Agronomy | 6 of 91 | 1 | Gold |
| Frontiers in Plant Science | 35 | 4.40 | Plant Science | 19 of 234 | 1 | Gold |
| Rice | 30 | 3.91 | Agronomy | 10 of 91 | 1 | Green |
| Plos One | 28 | 2.74 | Multidisciplinary Science | 27 of 71 | 2 | Green |
| Scientific Reports | 26 | 3.99 | Multidisciplinary Science | 17 of 71 | 2 | Green |
| Journal of Experimental Botany | 16 | 5.91 | Plant Sciences | 14 of 234 | 1 | Green |
| Plant Biotechnology Journal | 14 | 8.15 | Biotechnology and Applied Microbiology, Plant Sciences | 10 of 156; 9 of 234 | 1;1 | Green |
| Crop Protection | 12 | 2.38 | Agronomy | 19 of 91 | 1 | Green |
| Euphytica | 12 | 1.61 | Agronomy, Horticulture and Plant Sciences | 37 of 91; 11 of 36; 113 of 234 | 2;2;2 | Green |
| Theoretical and Applied Genetics | 12 | 4.44 | Agronomy, Genetics & Heredity; 3;3Horticulture and Plant Sciences | 5 of 91; 35 of 172;2 of 36, 18 of 234 | 1;1;1;1 | Green |
| Experimental Agriculture | 9 | 1.40 | Agronomy | 43 of 91 | 2 | Gold |
| Paddy and water management | 9 | 1.26 | Agricultural Engineering; Agronomy | 8 of 13; 47 of 91 | 3;3 | Green |
| Phytopathology | 9 | 3.23 | Plant Sciences | 44 of 234 | 1 | Green |
| Plant Production Science | 9 | 1.70 | Agronomy | 31 of 91 | 2 | Green |
| Soil Science and Plant Nutrition | 9 | 1.43 | Environmental Sciences; Plant Sciences; Soil Sciences | 212 of 265; 126 of 234; 28 of 38 | 4 ;3 ;3 | Green |

***Table 6.4. Most productive authors by institute, FP and h-index (those with h-index of more than 10 are included)***

| Author | Article numbers | h-index |
|---|---|---|
| Kumar A | 30 | 35 |
| Ali, J. | 24 | 21 |
| Ismail, AM | 24 | 21 |
| Li, Z | 21 | 25 |
| Kato, Y | 15 | 17 |
| Horgan, FG | 14 | 20 |
| Sandhu, N | 14 | 9 |
| Wang, X | 14 | 27 |
| Waassmann, R. | 14 | 47 |
| Sreenivasulu, N | 13 | 38 |
| Demon, M | 12 | 22 |
| Dixit, S | 12 | 2 |
| Kretzschmar, T. | 12 | 15 |
| Li, T | 12 | 12 |
| Saito, K. | 12 | 22 |
| Sander, B.O. | 12 | 8 |
| Singh, RK | 12 | 10 |
| Swamy, BPM | 12 | 22 |
| Jagdish, SVK | 11 | 22 |
| Jana, KK | 11 | 26 |
| Lee, JS | 11 | 43 |
| MacNally, KL | 11 | 28 |
| Oliva, R | 11 | 15 |
| Singleton, GR | 11 | 32 |
| Wissuwa, M | 11 | 33 |
| | 368 | |

***Table 6.5. Countries producing the majority of the research papers within the RICE CRP during 2017–19.***

| Country | Articles |
|---|---|
| Philippines, IRRI | 215 |
| France | 67 |
| USA | 61 |
| India | 49 |
| China | 47 |
| Germany | 38 |
| Australia | 35 |
| Japan | 31 |
| Netherlands | 21 |
| United Kingdom | 18 |
| Belgium | 15 |
| Benin | 12 |
| Vietnam | 12 |
| Bangladesh | 10 |
| Columbia | 10 |

***Table 6.6. Top RICE scientific outputs by citations per year (articles with more than 10 citations per year are included)***

| Authors and title | Journal | Year | Total citations | Citations per year | Lead author affiliation |
|---|---|---|---|---|---|
| Ezzati M, 2017 | Lancet | 2017 | 1387 | 346.7 | Imperial College, London |
| Wang W, 2017 | Nature | 2017 | 212 | 70.7 | Chinese Academy of Agricultural Sciences, Beijing |
| Zhao C | PNAS | 2017 | 273 | 68.2 | Peking University, Beijing |
| Crossa J | Trends in Plant Science | 2017 | 196 | 49 | International Maize and Wheat Improvement Center (CIMMYT), Mexico |
| Sten JC | Nature Genetics | 2018 | 103 | 34.3 | Cold Spring Harbor Laboratory, USA |
| Iqbal, N. | Frontiers in Plant Science | 2017 | 120 | 30 | Jamia Hamdard, New Delhi, India |
| Abudurexiti A. | Archives of Virology | 2019 | 59 | 29.5 | Centre for Disease Control and Prevention of Xinjiang Uygur Autonomous Region, Ürümqi, China |
| Per TS | Plant Physiology Biochem | 2017 | 105 | 26.2 | Aligarh Muslim University, India |
| Caine RS | New Phytologist | 2019 | 49 | 24.5 | University of Sheffield, UK |
| Maes P | Archives of Virology | 2018 | 72 | 24 | Zoonotic Infectious Diseases unit, Rega Institute, KU Leuven, Leuven, Belgium |
| Ismail AM | Annual Review Plant Biol | 2017 | 91 | 22.7 | IRRI, Philippines |
| Maes P | Archives of Virology | 2019 | 44 | 22 | Zoonotic Infectious Diseases unit, Rega Institute, KU Leuven, Leuven, Belgium |
| Per TS | Env Exp Bot | 2018 | 56 | 18.7 | Aligarh Muslim University, India |
| Gaydon DS | Field Crops Res | 2017 | 63 | 15.7 | University of Queensland, Australia |
| Wing RA | Nature Revie Genetics | 2017 | 45 | 15 | University of Arizona, USA |
| Mansueto L. | Nucleic Acid Research | 2017 | 60 | 15 | IRRI, Philippines |
| Oliva R | Nature Biotechnology | 2019 | 28 | 14 | IRRI, Philippines |
| Crain J | Plant Genome | 2018 | 42 | 14 | Kansas State Univ |
| Li J | Plant Biotechnology Journal | 2017 | 55 | 13.7 | China Agricultural University, Beijing |
| Berzrutczyk M | Plant Journal | 2018 | 40 | 13.3 | Max Planck Institute for Plant Breeding Research, Carl von Linné Weg 10, 50829 Köln, Germany |
| Wu W | Nature Plants | 2017 | 53 | 13.2 | China Agricultural University, Beijing |
| Tao H | Agric Water Manage | 2018 | 38 | 12.7 | Baoji University of Arts and Sciences, China |
| Varshney RK | Theor Appl Genet | 2019 | 25 | 12.5 | ICRISAT, India |

| Authors and title | Journal | Year | Total citations | Citations per year | Lead author affiliation |
|---|---|---|---|---|---|
| Kumar V | Agric Ecosystem Environment | 2018 | 37 | 12.3 | IRRI, Philippines |
| Yin X | Plant Cell Report | 2017 | 49 | 12.2 | IRRI, Philippines |
| Macovei A | Plant Biotech Journal | 2018 | 36 | 12 | IRRI, Philippines |
| Jat HS | Arachis Agron Soil Sci | 2018 | 34 | 11.3 | CSSRI, India |
| Youssef HM | Nature Genet | 2018 | 45 | 11.2 | Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Corrensstr. 3, OT Gatersleben, D-06466 Stadt Seeland, Germany |
| Van OORT PAJ | Global Change Biology | 2018 | 31 | 10.3 | Africa Rice Center, Bouaké, Côte d'Ivoire |
| Choudhary M | Geoderma | 2018 | 30 | 10 | CSSI, India |

### *6.7. Training activities provided by RICE to NARS during the review period 2017–19. Gender wise participants trained by each center are provided*

#### *6.7a. Short term plus participants in CGIAR activities such as farmer field days (end users and next users)*

| Center | Male | Female | % Women | Total |
|---|---|---|---|---|
| **AfricaRice** | 2,929 | 975 | 25.0 | 3,904 |
| **CIAT** | 531 | 179 | 25.2 | 710 |
| **IRRI** | 40,706 | 24,575 | 37.6 | 65,281 |
| **Cirad** | 18 | 12 | 40.0 | 30 |
| **JIRCAS** | 13 | 16 | 55.2 | 29 |
| **IRD** | 34 | 18 | 34.6 | 52 |
| **RICE total** | 44,231 | 25,775 | 36.5 | 70,006 |

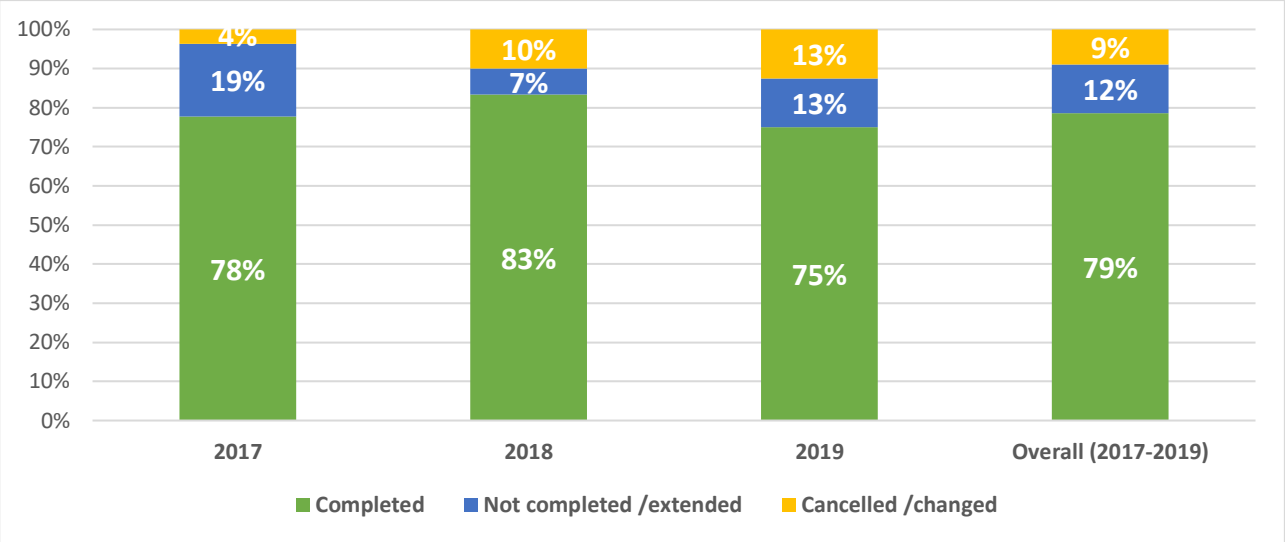
#### *6.7b Scholars (BS, MS, PhD, interns, on the job training, visiting scholar/fellow) trained during the review period*

| Center | Male | Female | % Women | Total |
|---|---|---|---|---|
| **AfricaRice** | 27 | 57 | 67.8 | 84 |
| **CIAT** | 1 | 7 | 87.5 | 8 |
| **IRRI** | 195 | 175 | 47,3 | 370 |
| **Cirad** | 14 | 26 | 65.0 | 40 |
| **JIRCAS** | 4 | 0 | 0.0 | 4 |
| **IRD** | 24 | 28 | 53.8 | 52 |
| **RICE total** | 265 | 293 | 52.5 | 558 |

# Annex 7: Milestone Analysis

The RICE CRP completed 76% of its planned milestones (89) on time. 22% milestones were extended/revised and only 2% milestones were cancelled. This demonstrates effective planning and execution (dashboard data, annual reports and KII). A year-wise summary of milestone achievement of the CRP is presented in Figure 1.

***Figure 1 Percentage of milestones completed by RICE CRP, by year***




All flagships, except FP4 have achieved most of their milestones within the desired timeframe. FP4 has achieved 47% of its milestones on time, while 33% milestones were extended, and 20% milestones were cancelled or changed. This occurred due to staffing and other internal challenges that the flagship has faced.

In some cases, milestones are formulated ambitiously and marked as complete without necessarily achieving the fuller stated intent e.g., sufficient commercial seed produced by the seed system to provide seeds for at least 5 million farmers, of which at least 50% are women, at the key action sites (2018), the progress reported on this indicate that estimated 43,200 farmers might have benefited from expected production of 1080 ton of certified seeds. This is far from achieving from reaching 5 million farmers as stated in the milestone in 2018. This is observed across several milestones marked complete (see examples cited in the table below). Clearly a good deal of work still to be done for achieving milestones and associated flagship level outcomes e.g., effective public and private delivery systems for seeds of improved rice varieties in six countries (Bangladesh, India, Nepal; Nigeria, Senegal, Tanzania). It is possible that a critical understanding of what 'remains to be achieved' is implicitly understood by the scientists leading the work on the milestone, which continues to guide the further work in that direction. However, in CG and donor reporting, these realities are under-captured.

***Table 3 Examples of ambitiously designed milestones***

| FP | Year | Milestone | Analysis of evidence presented by RICE, when marking the milestone as complete |
|---|---|---|---|
| 1 | 2018 | Sufficient commercial seed produced by the seed system to provide seeds for at least 5 million farmers, of which at least 50% are women, at the key action sites | Evidence presented points to an estimated 43,200 farmers benefiting from certified seed delivery |
| 1 | 2018 | Gender-youth business models in rice value chain reinforced through better understanding of changing roles on decision making of women and youth in rice farming | Research conducted by the CRP highlights constraints to participation of women in the business models. Evidence on how the CRP work leads to development of new or improvement of existing business models, while addressing the highlighted constraints, is unclear. |
| 1 | 2018 | Application of the rice monitoring system for national food security program in Cambodia, supporting Thailand disaster relief program for rice farmers, crop insurance implementation in Tamil Nadu, India, Cambodia and Mekong River Delta, Vietnam, and development of remote sensing-based rice monitoring system for Bihar, India | Evidence is presented from Tamil Nadu in India, where significant progress is achieved, and evidence of this progress is unambiguous. However, the evidence for other sites of rice monitoring system is less clear in terms of what is the status of work there. It is understandable that work on other sites may not be as advanced as is the case with Tamil Nadu. It may be so that there is higher level of regulatory and other challenges at other sites of operation of the rice monitoring system. |
| 1 | 2019 | Piloting innovative business models on emerging opportunities for women and youth in the rice sector in selected countries in two countries in Asia and two in Africa | Evidence as presented is seemingly not adequate to indicate completion of milestones or the milestone wordings should be revised. Evidence presented is recaptured here - To help overcome the challenges youth face in rural areas, the promotion of youth entrepreneurship and job creation in the West African rice value chain (PEJERIZ) project aims to expand sustainable entrepreneurial and employment opportunities for rural youths by actively engaging them in the improvement of rice value chains. |
| 1 | 2019 | 50% of key regions have at least one functional multi-stakeholder platform or improved seed system at key action sites | Evidence presented indicates SRP as a platform active in 130 countries. SRP presence is not indicative of improved seed system at key actions sites, Also, it is not evident that RICE has played a major role in establishment of SRP across 130 countries. |
| 2 | 2019 | Rice market value captured by women scale-processors increased thanks to the improved parboiling system introduced for rice products diversification in Cote d'Ivoire. | Evidence presented indicates CRP participation in the Bouaké innovation platform at SARA 2019 in Cote d'Ivoire. This led to the publication of a paper and support to two MSc theses. These achievements are not sufficiently indicative of the completion of the milestones as stated or worded presently. |
| 3 | 2019 | Male and female farmers participating in demonstration reduce rice yield gaps by 10-15% at six action sites | Evidence presented indicates that introduction of technical innovations developed in RICE CRP has shown 10% yield increase in 8 countries including Benin, Brazil, India, Madagascar, Nigeria, Tanzania, Togo, Uganda, and Vietnam. This is not indicative of impact at demo sites and not of out scaling and/or wide-scale adoption. |

# Annex 8: Policy Analysis

RICE has rightfully invested in policy analysis (where a whole cluster of activity is devoted under FP1), rice value chains (FP2), farming systems (FP3), nutrition security (FP 3 and 5), digital agriculture for outreach (FP3), modernizing and streamlining breeding (FP5). RICE achieved strong policy engagements in both African and Asian countries. Africa influence was achieved through regional framework/platforms such as CARD and AfricaRice, while the Asian influence was achieved through specific country level policy engagement. Vietnam, the Philippines, India and Bangladesh are cited as good policy influence examples of RICE (KII, Annual reports). Overall, RICE has reported to have informed/influenced 25 policies during 2017–19.

***Table 4 Select/significant examples of policy contributions of RICE during 2017–19, by level of contribution****

| Type of policy contribution | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| Policy or strategy | • Partnership with international organizations and universities to investigate the role of policy support in curbing GHG emissions and to develop outlooks of the rice economy | • Expansion of the 'Seeds Without Borders' agreement with Bhutan. Bhutan can now import improved variety seeds without much hassle from six countries in the region. Bangladesh, Cambodia, India, Myanmar, Nepal, and Sri Lanka are the other members of the network agreement.<br>• The regional agricultural policy on rice in West Africa<br>• Policy for restructuring the Vietnamese rice sector<br>• Access to released varieties in ECOWAS member countries | • Vietnam policy supports for "1M5R" practice |
| Legal instrument | • Philippine House Bill No. 4269: An act to promote and accelerate farmland land leveling and reconstruction in agricultural production areas, and for other purposes | • Institutionalization of PRISM within the Philippine Department of Agriculture. Administrative Order signed by Department of Agriculture Secretary creating PRISM unit within PhilRice.<br>• Philippine Law No. 10601, otherwise known as "Agricultural and Fisheries Mechanization (AFMech) Law | |
| Budget or investment | • 'Continental Investment Plan for accelerating Rice Self-Sufficiency in Africa' to support African countries to attain rice self-sufficiency. ECOWAS Regional Rice Offensive<br>• National investment informed by RICE research: Small Farm Large Field programs in Vietnam and Myanmar<br>• GHG-NAMAs in Thailand and Vietnam<br>• Creating an enabling environment for crowding in private sector investment in sustainable | • National investment informed by RICE research: Philippine Rice Road Map | |

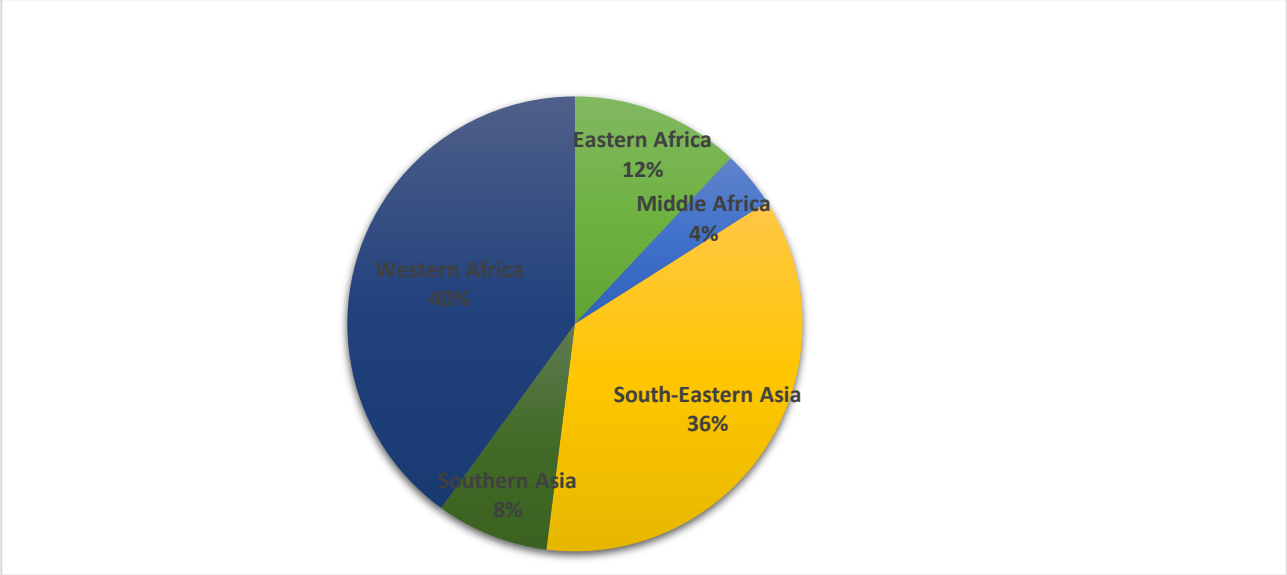
| Type of policy contribution | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| | production standards throughout rice value chains in Vietnam<br>• Investment Policy for Rice Self-Sufficiency in The Gambia (CIPRiSSA-The Gambia) | | |

**Definition of levels of policy contribution:*

| | | |
|---|---|---|
| **Level 1.** Research taken up by next user (decision maker or intermediary) | **Level 2.** Policy/law etc. enacted | **Level 3:** Evidence of impact on people and/or natural environment of the changed policy or investment |

RICE policy contributions are skewed towards two main regions – South East Asia and West Africa (Table 5). A break-up is presented in Figure 2 below.

Figure 2. Proportion of policies informed/influenced by region (25 policies)




The Philippines and Vietnam stand-out as prime examples of countries that have influenced and improved policymaking. The FP3 team has helped establish a rice sector platform for building incentive mechanisms for sustainable production in Vietnam. Improved rice management practices that reduce GHG emissions have also been adopted in Vietnam. In the Philippines, the Department of Agriculture funded a project on sustainable rice straw management for scaling mechanized rice straw collection, mushroom production, animal fodder, and rice straw logistics models.

# Annex 9: Innovations Analysis

The RICE CRP has demonstrated a stellar performance in discovery and delivery of science in rice agri-food system. RICE has built up well on its GRiSP legacy and continued to deliver credible science. RICE has a pipeline of 224 innovations. 48% of these innovations are promising ones and have achieved stage 3 or 4 level of uptake. 49% of RICE innovations are related to production system and management practices and about 22% are germplasm related. The table below provide a snapshot of significant RICE innovations.

***Table 5. Select/significant examples of RICE innovations during 2017–19, by stage of innovation****

| Type of innovation | Stage 1 | Stage 2 | Stage 3 | Stage 4 |
|---|---|---|---|---|
| Germplasm | • QTL for Anaerobic germination (global)<br>• Genome editing using CRISPR/Cas9 as a technology to accelerate precision breeding (global)<br>• Multiline variety for blast resistance (global)<br>• Stomate reduction, gene validation (global)<br>• Identification of non-commonly shared specific genes in wild and cultivated African rice (global) | • Identified novel genomic regions that associate with starch-based properties of the rice grain using the genome-wide association study (global)<br>• Low glycemic rice (global)<br>• Identification of a high-Zinc IRRI-Genebank accession and associated chromosomal positions (global)<br>• Sheath blight tolerance, phenotyping (global) | • Identification of new donors, QTLs and genes for biotic and abiotic stresses (global)<br>• High zinc rice germplasm employed to develop pre-breeding material in high yielding background (global)<br>• Array sites established in multiple locations in India, Southeast Asia, Latin America, and Africa (global)<br>• Development and out-scaling of aromatic hybrid rice varieties in Sub-Saharan Africa | • More than 10 lines from GRiSP nominated for release by national partners; from FLAR germplasm released in LAC (regional)<br>• Green Super Rice varieties (global)<br>• Flood-tolerant rice varieties for Bangladesh (sub1) (Bangladesh)<br>• Premium Quality Rice (PQR) varieties BRRI Dhan 50 and 63 (Bangladesh) |
| Research and communication methodologies and tools | • Yield trends predictions in relation to climate variation and adaptive traits (regional)<br>• PhenoSense (global)<br>• Application of AMMI model to multi-site data allowed exploration of G x E effects in GWAS (global) | • AutoMonPH- a decision tool for system level water management using AWD principle<br>• Pathotracer, a platform to take informed decision on rice diseases (global) | • Novel tools to assess milling and cooking quality has been established and applied to screen the breeding material (regional)<br>• Rice Doctor Odiya (India)<br>• Weather-rice-nutrient integrated decision support system (WeRise) in Indonesia | • RiceAdvice (Nigeria)<br>• Rice Crop Manager (RCM) (Philippines)<br>• Safe alternate wetting and drying (AWD) protocol (water-saving tech.) (South and Southeast Asia) |
| Production systems, value chains and management practices | • GrainSafe Dryer and hermetic rice storage system (South-Eastern Asia, Southern Asia, Western Africa)<br>• Rice straw pelleting (global) | • Laser land leveling (Indonesia, Philippines, Myanmar, Sri Lanka)<br>• Alternate wetting and | • GEM and Mini GEM parboiling technology (West Africa)<br>• Solar Bubble Dryer Version 2 (global where needed)<br>• Micro-dosing fertilizer application | • Satellite-based rice monitoring - Philippines (PRISM); Cambodia, Vietnam (RIICE, www.riice.org); (India: Odisha, Andhra Pradesh) |

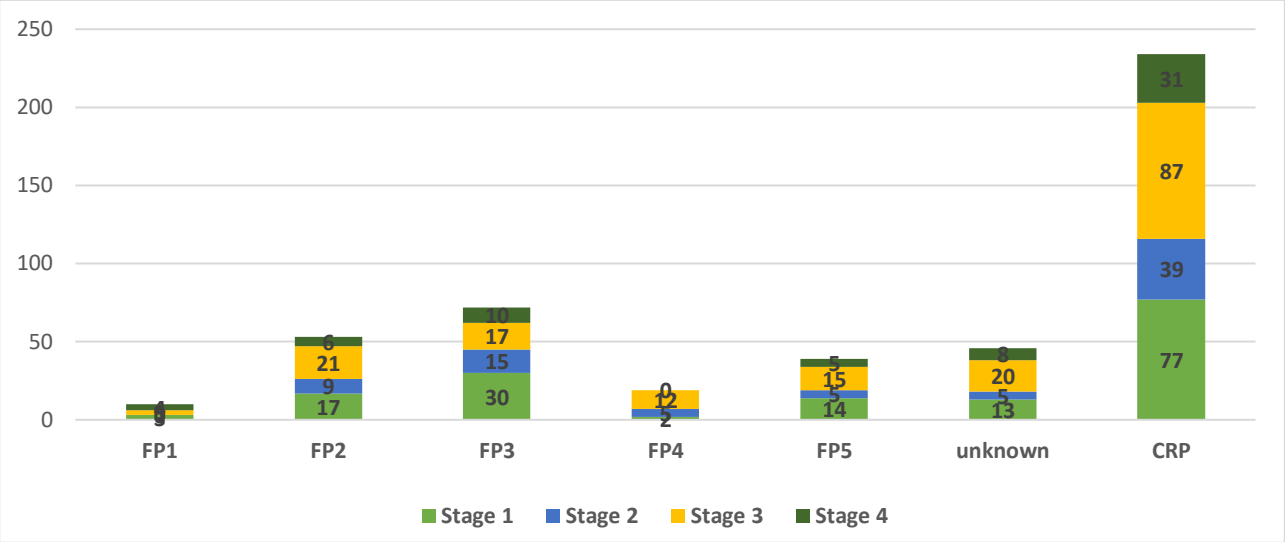
| Type of innovation | Stage 1 | Stage 2 | Stage 3 | Stage 4 |
|---|---|---|---|---|
| | • EasyHarvest: App for optimized combine harvester scheduling<br>• Cropping calendar construction model (global)<br>• Anaerobic digestion of rice straw, household batch system (Philippines)<br>• Semi-automatic rice husk furnace (Cambodia, Myanmar) | drying (AWD) (Africa)<br>• Bio-diversified upland rice-based cropping systems designing (Madagascar)<br>• Solar Bubble dryer (Nepal) | for direct seeding (Dibbled seeding in non-flooded conditions in poor soils in sub-Saharan Africa)<br>• Technology and Business model for mechanized rice straw collection (Cambodia, Vietnam, Philippines, Myanmar)<br>• ASI and Mini-ASI Thresher (West Africa) | • IRRI Rice Quality Kit (global)<br>• 1 Must 5 Reductions (1M5R)' integrated rice management package (Vietnam)<br>• Alternate wetting and drying (AWD) (China, Vietnam, Bangladesh, Philippines, Thailand)<br>• Smart-Valleys approach (Benin, Togo) |
| Social science | • Training on investment in upgraded milling technologies in West Africa (SSA) | • Improved water governance (Bangladesh)<br>• Learning Alliance for Scaling (Myanmar)<br>• Climate change adaptation: Salinity monitoring system (in collaboration with CCAFS) (Vietnam) | • Climate change adaptation: Climate smart villages (in collaboration with CCAFS) (Vietnam, India)<br>• The Direct Seeded Rice Consortium is a public-private multi-stakeholder research for development platform, with 26 members, out of which 8 are from private sectors<br>• Partnership with the Latin American Fund for Irrigated Rice (FLAR) - a public-private partnership of over 30 organizations in 17 Latin-American countries | • SRP Standards and performance indicators (global)<br>• Learning Alliances (Thailand, Vietnam, Philippines)<br>• Seeds without borders (South Asia) |
| Biophysical research | • Remote sensing and real-time crop management (Philippines, India)<br>• No-tillage Rice based cropping system with stylosanthes cover crop managed by an efficient animal traction roller (Africa) | • Ecological engineering with vegetables (Cambodia, Indonesia) | • MINCER micrometeorological station used to improve spikelet sterility estimations in crop models (global) | |

**Definition of stages of innovation:*

| | | | |
|---|---|---|---|
| 1 = Discovery/proof of concept | 2 = Successful piloting | 3= Available/ready for uptake | 4 = Uptake by next user |

As seen above, there are very few Stage 4 innovations reported (14%).

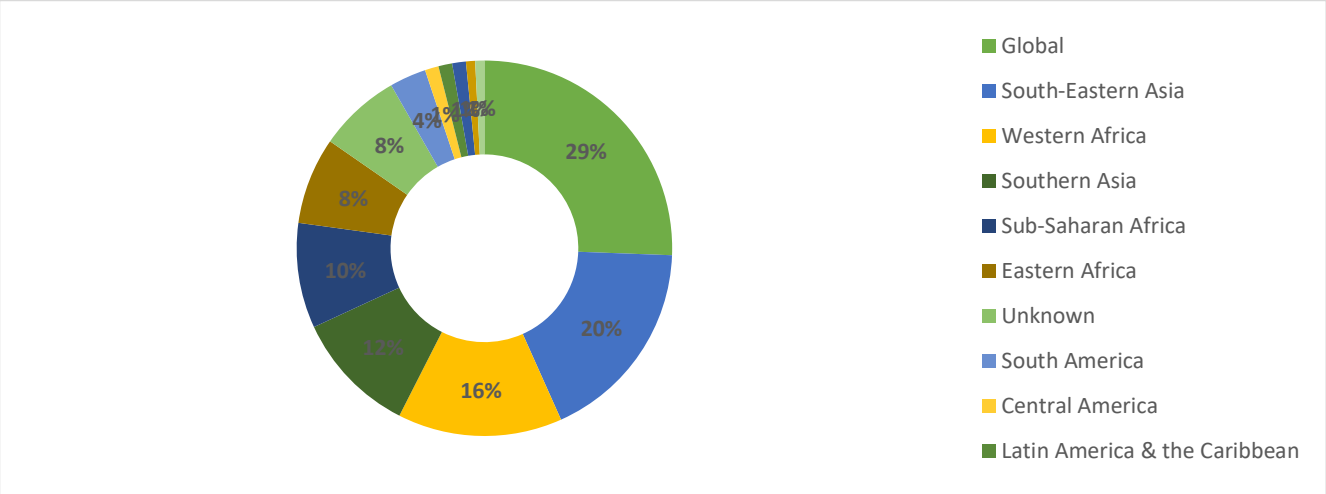
***Figure 3. Number of RICE innovations by stages of innovation (224 innovations reported during 2017–19)***




As per the CRP team, that has mostly to do with the stringent requirements on Stage 4 reporting as project or partner reports etc. are considered insufficient. A Stage 4 reporting level requires a peer-reviewed journal publication to be adopted. Such peer-reviewed publications need to be based on state-of-the-art methodologies such as randomized control trials etc. Since it's very costly to perform such assessments, and since the process of publishing these studies is long, RICE have very few Stage 4 level reported innovations. The CRP team believes that in reality, several instances of dissemination or adoption have taken place at Stage 4, even though these are reported at Stage 3 or 2 to comply with the reporting requirements. Having said that, RICE scientists and stakeholders recognize that the challenge for RICE is to scale up these innovations. Our analysis indicates that at least one third of RICE innovations do not get followed up, either due to funding constraints or the priorities of the program or partners change.

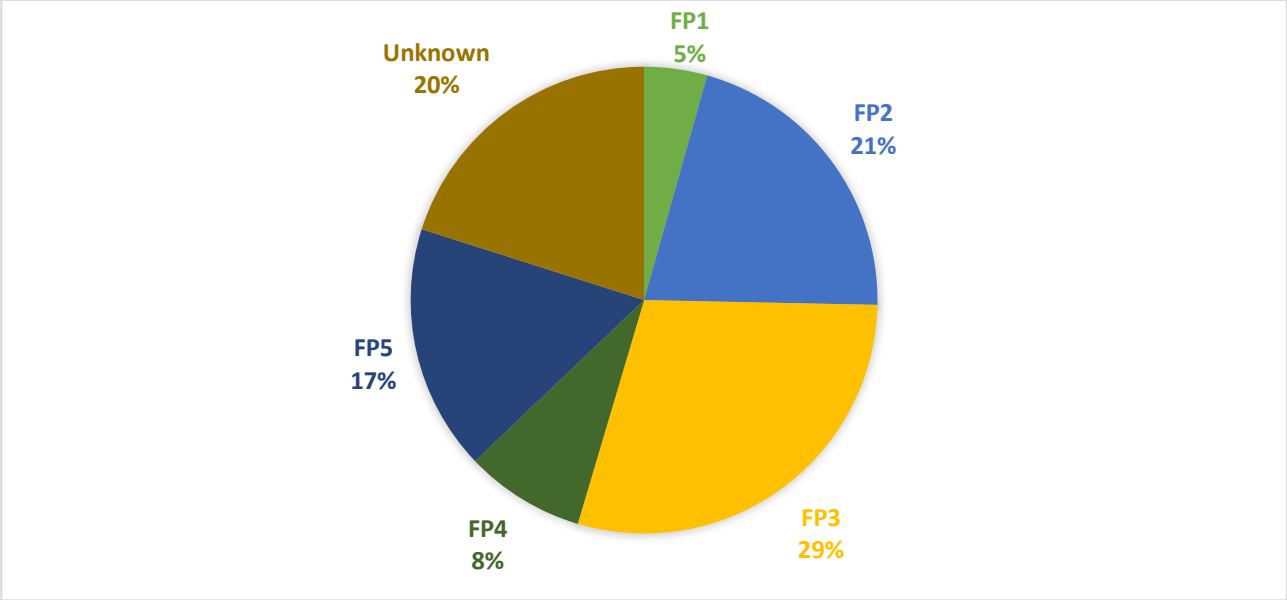
RICE innovations have achieved wide geographical reach as is shown in Figure 4 though South East Asia (20%), West Africa (16%) and South Asia (10%) are top three regions.

***Figure 4. Regional spread of RICE innovations***



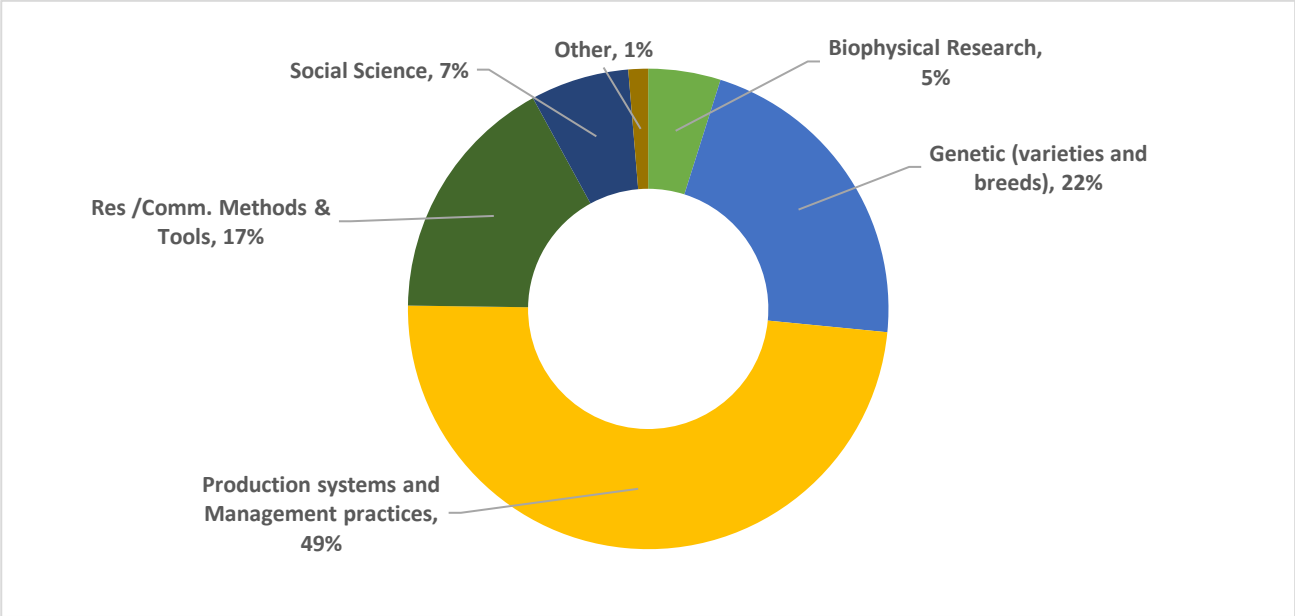
In terms of flagships, RICE innovations are most accounted for by the work of FPs 2 and 3 as shown in Figure 5.

***Figure 5. Proportion of RICE innovations by flagship, 2017–19***




The types of RICE innovations vary from germplasm research to production and management systems and from social sciences to bio-physical sciences. A synopsis of RICE innovations is captured in Figure 6 below.

***Figure 6. Typology of RICE innovations, 2017–19***




Taking RICE innovations on the scaling pathways would require stable and sturdy partnerships as is being fostered by seed systems work of FP1, FP2 and FP3. Evidently, expanded seed system and private sector engagement would be needed in the remainder timeframe of the CRP.

# Annex 10: Theory of Change Analysis

The RICE ToC is logically structured at four levels of impact pathway: 1) Discovery Research, 2) Product, 3) Adoption, and 4) Outcome. This nomenclature used by the RICE ToC is as follows:

- 'Discovery research' corresponds to research activities
- 'Product' corresponds to immediate research outputs
- 'Adoption' corresponds to research uptake
- 'Outcome' corresponds to development outcome and subsequently impact

These definitions are used throughout this ToC analysis and in further annexes for gender analysis, youth analysis, climate change analysis, capacity development analysis, nutrition analysis, innovation analysis etc.

A detailed analysis of RICE progress on flagship level theories of change is presented in the tables below.

Flagship 1 in RICE has spent 15 million USD annually (on average). Despite budget uncertainties, FP1 have managed to get steady budget, which demonstrate the priority attached to the flagship work. In fact, FP1 received 2% higher than budgeted money over 2017–19. A detailed analysis of RICE progress on FP1 theory of change is presented in Table 7.

***Table 6. Assessment on the RICE Flagship 1 Theory of Change***

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Discovery research**/activities | Reflective learning, foresight scenario, partner and stakeholder assessments, socio-economic and market information. | FP1 conducted an annual workshop called Monitoring, Evaluation, Learning, Impact Assessment, and gender (MELIAG). The focus of these workshops has been the analysis of, planning of documentation, and outcomes and impacts of the RICE CRP. These interactions involved all FPs and so have contributed to development of an 'impact culture'. FP1 revised its impact evaluation strategies by 1) moving beyond assessing the impact of germplasm, 2) bringing in experimental methods in impact evaluations, 3) conducting more cross-cutting analysis in impact evaluations. Overall FP1 have shown strong performance in conduct of its activities as is shown in the milestone analysis (see Annex 7). |
| **Product**/research outputs | Opportunities for women and youth identified; Technology needs identified; Capacity development needs identified; Better targeting of technology development. | Several opportunities for women and youth participation in RICE program were identified e.g. innovative business models in the rice sector were piloted, seed multiplication & delivery systems were developed involving women. Challenges remained, in terms of access to finance, in capitalizing on these opportunities to take them forward.<br><br>FP1 identified technology needs and better targeting of technologies through 13 product profiles, and prepared a rolling plan based on progress of technologies along the impact pathway. FP1 also successfully conducted rice supply-demand scenario analyses, horizon scanning, and target domains for RICE technologies.<br><br>FP1 tested new approaches for policy engagement in three countries (Papua New Guinea, Philippines, and Indonesia) with the ambition to show the usefulness of using policy-oriented research outputs in policy processes to increase the influence of IRRI in policy circles.<br><br>As a result of all the work of FP1, it is less clear how capacity development needs at various scales were identified, prioritized, and fed back for priority setting for other flagships. Informing and influencing the work of other flagships is considerably challenging as priorities are guided by several factors, not least of which is the availability of bilateral funding to carry out the work. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Adoption**/immediate outcome or research uptake | Evidence based sector development recommendations; Scaling partners mobilized; Effective innovation platforms; Effective management of RICE. | FP1 generated evidence and recommendations through impact assessments (such as AWD, Rice Crop Manager, RiceAdvice). Several FP1 publications have highlighted largely positive assessments as opposed to challenges in uptake and implementation. The balance in terms of 'proving' and 'improving' was tilted in favor of the former.<br><br>One of the successes of FP1 is in mobilizing scaling partners e.g., a RICE partner is working in Eastern India with nearly 5000 women farmers for demonstration of several stress-tolerant varieties, closely related to quality seed production.<br><br>FP1 extended the remote-sensing based rice monitoring work to Cambodia and Mekong River Delta, Vietnam.<br><br>FP1 has established at least one functional multi-stakeholder platform in Nigeria, Benin, Uganda, and Madagascar. IPs have also been initiated in Senegal, Ghana, and Cote d'Ivoire.<br><br>Overall, FP1's dedicated work contributed to effective management of RICE. FP1 work is ambitious as it involves working across flagships and centers on a range of areas where priority setting is needed and where bottlenecks are being experienced. FP1 would need to work more on critical analysis of promising RICE innovations on the scaling pathway, as it could help in identifying bottlenecks in scaling and in identifying appropriate partners that can address the barriers to scale. |
| **Outcome** | Better functioning national and international rice markets; Better delivery partnerships with capacity to innovate | Establishment of a formal Economic Rice Observatory in FLAR member countries is a relevant example of FP1 contribution to effective functioning of national and international rice markets. The Economic Rice Observatory has incorporated additional indicators to track rice value chain information and draw policy lessons across the region. This initiative is supported by the Latin American Confederation of Entities of Rice (CELARROZ) which is interested into diverse market-related research topics. Similarly, CARD work in Africa, facilitated by FP3, contributed to this outcome.<br><br>Delivery partnerships constitute about 25% of all RICE partnerships (dashboard data). As RICE has huge pipeline of innovations waiting to be taken to the scaling pathways, it might be pertinent for flagship 1 to oversee the expansion of delivery partnerships. |
| **Impact** | Equity and inclusion achieved; National partners and beneficiary enabled; Enabling environment improved | FP1, working with other flagship team and partners, facilitated equity and inclusion e.g., for women entrepreneurs in agriculture mechanization in Bangladesh, harvesting of paddy by reaper which led to improve incomes (estimated USD392-503 per year).<br><br>FP1 contributed to informing/influencing at least 2 agri-food policies and have worked on for improving enabling environment e.g., in Vietnam and Cambodia, laser land leveling has been extensively demonstrated and services are provided by government institution.<br><br>Policy impact of RICE is significant in West Africa and South East Asia. Continuing policy engagement, as part of the future format of RICE CRP, is needed in the regions where RICE already have made inroads into policy circles but also in regions and countries where RICE has played a limited role so far. |
| **Enabling actions** or strategies to achieve the stated results | Foresight and priority-setting activities are the basis of evidence-based decision making by program/project | While the enabling actions were undertaken, it is difficult for this review to establish effectiveness of the enabling actions. The flagship team can reflect on the extent to which enabling actions taken were able to address the constraints related to adoption and impact. Reflections would also be needed to analyze what new enabling actions would be needed to improve progress on the theory of change. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | management and senior research leaders in allocating resources where they have the greatest impact potential; The gender-disaggregated findings of socioeconomic analyses of farm households on technology needs of farmers, technology performance in farmers' fields, and adoption constraints are expected to improve product development and the formulation of supportive policies for their scaling-out and adoption | |
| **Risks and assumptions**, during result-transitions in the theory of change | Much relies on the presence and quality of data. Engagement of national partners will be sought to collect, verify, and take ownership of national and subnational data; Inappropriate policies (outcome to impact); Disconnect between research and delivery (immediate outcome to outcome); Benefits of RICE not clear to stakeholders (Immediate outcome to outcome); Insufficient feedback and learning in RICE (output to immediate outcome) | Several scientists commented that reliable government data is found to be difficult to obtain while doing impact evaluation. This can compromise the quality and validity of impact analysis, if for example, a government in a country want to project their successes /achievements through unverified datasets.<br><br>The team should reflect on assumptions made, and risks experienced between 2017–19 and identify strategies to address some of the barriers to its work to achieve better impact. |

Flagship 2 in RICE has spent 3 million USD annually (on average). FP2 work has received less attention and fewer funds. FP2 has in fact received only 4% of the CRP budget. (CG Dashboard, KII). A detailed analysis of RICE progress on the FP2 Theory of Change is presented in Table 8.

***Table 7. Assessment on the RICE Flagship 2 Theory of Change***

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Discovery research** / activities | Prototype upgrading, post-harvest technologies and practices, nutritious and healthy rice varieties, prototype novel food products and by products | Despite its limited resources, the flagship has accomplished a large amount of work through foresight and dedication from expert scientists. |
| **Product** /research outputs | Validated upgrading strategies; validated upgraded post-harvest technologies, rice varieties, novel products and by products | FP2 have performed well in terms of upgrading strategies, technologies, and products. The following are some examples:<br>• Prototypes of GEM technologies using rice husk as fuel and rice husk gasifier stoves<br>• Developing and piloting several innovations in Asia (rice husk furnace, rice straw furnace, rice straw feed, rice straw mushroom, LCA-rice straw, rice straw pelleting, and rice straw batch biogas production, postharvest business models for threshing, drying and storage were demonstrated in Myanmar etc.<br><br>FP2 have consciously focused on upgrading strategies that can benefit women and youth e.g.<br>• Access to finance for women and youth for venturing into the Rice Value Chain is constrained by high initial capital requirements.<br>• Diversified enterprise opportunities<br>• Gender-responsive product profiling, accelerated breeding, food choice, and women's empowerment<br><br>FP2 identified new business ideas and new employment opportunities for women and youth in Nigeria such as:<br>• Rice based products processing and marketing<br>• Fabrication and selling of rice husk briquettes<br>• Paddy seedling production and marketing<br>• Rice husk fueled gasifier cookstoves production<br>• Rice oil extraction<br>• Processing of rice bran into building blocks etc.<br><br>FP2 identified ways to improve value chain efficiency through contract farming approaches. A research on sustainable rice value chain upgrading generated a noteworthy policy publication on inclusiveness of contract farming (Ba et al., 2019, Land Use Policy).<br><br>FP2 also conducted climate change related work which included:<br>• Publishing several scientific articles<br>• Publishing Springer book on sustainable rice straw management<br>• Standardizing several locally fabricated technologies (Mini-GEM system, Mini-ASI, Paddy cleaner, Rice grader and different rice husk gasifier stoves) with private sector and showcasing them at a major agricultural forum in Africa. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Adoption** /immediate outcome or research uptake | Improved market linkages; Improved connectivity among all value chain actors | FP2 has shared outputs through multi-stakeholder forums and other innovation platforms to improve funding and commitments to improve scale-up of its several innovations.<br><br>FP2 has piloted several technologies such as improved parboiling system introduced for rice products diversification in Cote d'Ivoire; business models for service providers for crop establishment were piloted in Bangladesh, Solar Bubble Dryer was introduced in Nepal for summer rice.<br><br>FP2 developed a draft policy brief for institutionalizing sustainable rice production guidelines in Vietnam, which can be considered as a first step in mitigating climate change in the rice sector with important spillover potential to other countries.<br><br>FP2 developed a regional value chain upgrading strategy for Africa. |
| **Outcome** | Large scale adoption by value chain actors; Increased productivity | Some large-scale adoption of rice value chain technologies is reported, for example in Nigeria, the GEM Parboiling technology installed in Lafia Innovation platform, hermetic super grain bag is a big commercial success (5 million bag sold annually) and as per GrainPro is one of the products that keep them profitable (KII).<br><br>Some promising research areas have been significantly expanded as per the annual report of RICE - The Department of Agriculture in the Philippines funded a project on sustainable rice straw management for scaling mechanized rice straw collection, mushroom production, animal fodder, and rice straw logistics models in the Philippines.<br><br>Evidence available indicates that several innovations have so far remained at 'Product' level and RICE would need to work on scaling up pathways to achieve better 'adoption' and 'outcomes' as per the defined Theory of Change. RICE in the next phase would need to dedicate a appropriate resources for scale-up. |
| **Impact** | Increased profitability of value chain actors; Affordable price of high-quality rice to consumers; Increased incomes and employment | In Nigeria, the GEM Parboiling technology is reported to have produced multiple benefits such as (i) a cleaner and higher-quality product resulting in 50% increase in price above that of traditionally parboiled rice, (ii) reduced wood consumption by 40% and the exposure of the users to smoke and heat compared to the traditional parboiling, (iii) less time-consuming and safer to operate - particularly for female and younger processors. parboilers that use the GEM technology make at least an extra 82 USD on every ton of rice parboiled compared to parboilers using the traditional system; further evidence on impact comes from AfricaRice work in Cote d'Ivoire which led to increase in the value of milled rice from 350 FCFA to 450 FCFA per kg leading to better incomes for women in select groups.<br><br>Impact, as presented above, is so far limited. It is evident that more investments and partnerships (delivery partners, private sector partners) would be needed for a similar scale of impact as seen in the case of GEM parboiling. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Enabling actions** or strategies to achieve the stated results | Enhanced small holder market access; Branding, awareness creation and certification; Gender and youth disaggregated needs assessment and products; Impact assessment - gender disaggregated; Policy recommendations /dialogue; Encourage horizontal and vertical coordination; Facilitation of multi-stakeholder platforms | FP2 have shown foresight in ensuring several enabling actions as envisaged in its Theory of Change. It has shared its research outputs and innovations at multi-stakeholder forums and within policy circles. It has been successful in some countries (Nigeria, Cote d'Ivoire, Vietnam, Philippines) however more work is required on this front. FP2 have recently secured a new partnership with the Islamic Development Bank to implement the Regional Rice Value Chain Program in 10 African countries.<br><br>While enabling actions were taken, it is difficult for this review to establish the effectiveness of such actions. The flagship team can reflect on the extent to which the actions taken were able to address the constraints related to adoption and impact. Analysis of new enabling actions to improve progress on the Theory of Change requires further reflection. |
| **Risks and assumptions**, during result-transitions in the theory of change | Consumer do not buy upgraded varieties and novel products (outcome to impact); value chain upgrading not gender or youth inclusive (immediate outcome to outcome); Lack of competitiveness in the market (immediate outcome to outcome); Unfavorable policies (immediate outcome to outcome); Quality is not rewarded by market (immediate outcome to outcome); Public sector actions /regulations adverse to rice sector development / new varieties /novel products (immediate outcome to outcome) | The flagship team should reflect on assumptions made and risks experienced between 2017–19 and identify strategies to address some of the barriers to its work to achieve better impact. |

Flagship 3 in RICE has spent 18 million USD annually (on average). Facing uncertainty, FP3 budgets were significantly reduced accounting for 70% of reductions across the CRP. This has compromised out scaling activities at FP3, potentially limiting the achievements of RICE on wide scaling. A detailed analysis of RICE progress on FP3 theory of change is presented in Table 9.

***Table 8. Assessment on the RICE Flagship 3 Theory of Change***

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Discovery research**/activities | Long term experiments, participatory trials, innovation platforms, integrated crop farming system and climate forecasting models, diversification options, field calculator for sustainability indicators | There is clear evidence of the flagship conducting a range of research innovations to develop technologies, prototypes, diversification options for closing the yield gap, and improving environmental sustainability. Several of RICE technologies have seen pilot scale experimentation while some have moved to large-scale adoption and impact. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Product**/research outputs | Technologies that reduce women's labor and energy expenditure; Prototype rice management system; Prototype diversified farms, including animals and trees; Yield gap and environmental sustainability indices | FP3 has identified prototype labor-saving technologies for crop establishment and weeding, harvesting, and threshing and tested them at seven action sites.<br><br>For closing the yield gap, FP3 have identified integrated management options in Nigeria, Senegal, Madagascar, Bangladesh, Myanmar, Indonesia. Similarly, baseline yield gaps and constraints were quantified in Bangladesh, Thailand, Vietnam, Indonesia, Myanmar, Sri Lanka, and China (Guangdong Province).<br><br>FP3 identified promising diversification options in Cote d'Ivoire, Madagascar, Rwanda, Senegal. Rice-legumes rotation systems (pigeon pea, mung bean, and stylosanthes) were tested. Multidimensional benefits from promising diversification options were quantified.<br><br>Sustainable farming systems analyses platform was established within RICE and with other CRPs at six key action sites. Capacity development needs on sustainable farming systems were identified among partner research organizations and a collaboration in Madagascar across three centers (JIRCAS, AfricaRice, and CIRAD) was successfully established.<br><br>Options for reducing risks caused by climate risks identified at six action sites (Senegal, Madagascar, Vietnam, Indonesia, Myanmar) and GHG emissions and carbon capture benchmarked at three action sites. |
| **Adoption** /immediate outcome or research uptake | Crop, animal, and tree diversification options; Integrated and climate smart crop management options; Gender-equitable and youth inclusive farming systems; Learning based and gender-sensitive advisory services | FP3 has succeeded in taking some of its technologies, prototypes to the next user, for example:<br><br>• Integration of options for reducing risks caused by climate risks communicated to national policy framework<br>• Labor use efficiency and women empowerment indicators are included in the Sustainable Rice Platform (SRP) Performance Indicators and new version was piloted in 2017<br>• RICE contributed to development of revised SRP version 2.0 which provides 41 guidelines in rice cultivation covering farm management, water use, pest management, nutrient management, harvest and post-harvest practices, health and safety, and labor rights<br><br>The flagship team has helped establish a rice sector platform for building incentive mechanisms for sustainable production in Vietnam. It is important for the FP3 team to reflect on promising FP3 innovations where adoption is yet to happen. |
| **Outcome** | Large-scale adoption; increased productivity | Some evidence of flagship outputs being adopted at small-scale is available e.g. farmers reduced rice yield gaps by 10-15% at six action sites and GHG emission by 10-30% at three action sites.<br><br>Policy level adoption is spearheaded through demonstration of improved rice management practices that reduce GHG emission in Vietnam<br><br>Wide-scale adoption is reported by the "Closing Rice Yield Gaps in Asia with Reduced Environmental Footprint project (CORIGAP-PRO)" in China, Indonesia, Myanmar, Sri Lanka, Thailand, and Vietnam improved yield and income through innovations towards sustainable rice-based systems in these countries. The project's efforts in promoting best management |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | | practices for rice production have reached more than 600,000 farmers. About 118,000 farmers have adopted the best practices and increased their rice yield by 11-20%, and profit by 15-25%. Similarly, in Vietnam, the use of 1 Must 5 Reductions (11M5R) delivered by CORIGAP have shown adoption at a wide scale. |
| **Impact** | Increase profitability of farming; affordable price of rice to consumers; mitigation and adaptation achieved; increased incomes and employment; improved diets of poor and vulnerable people; more sustainably managed agro-ecosystems | FP3's digital technologies such as Rice Crop Manager have produced an income gain of 100-200 US$/ha in Asia, with about 1.3 M recommendations in Philippines and 55,000 in India. The RiceAdvice in Sub-Saharan Africa produces 100-250 US$/ha additional income and has been used about 40,000 times. Results of RCT in Nigeria show that treated households increase yields by 549 kg/ha compared to their matched control households (an increase of 15%). In the year 2019, a total of 19,756 farmers of which 2043 women received RiceAdvice recommendations and guidelines to cover 12,796 ha in Nigeria, Burkina Faso, Mali, Senegal.<br><br>Diffusion of salt-tolerant rice varieties (STRVs) promoted in the Mekong River Delta covering 47% of rice area and generated approximately 19 million USD in value added for the 2017/18 Dong Xuan season. Impact of drought-tolerant rice varieties (DTRV) in Benin, Madagascar and Nigeria found that their adoption improved household food security. The adoption of DTRV boosted rice yield by 570 kg/ha (24% increase), leading to an increase in household income by US$ 126 per ha.<br><br>On-farm assessment of different rice crop management practices in the Mekong Delta, Vietnam showed that improved practices including alternate wetting and drying (AWD) water management reduced GHG emissions by 39%. Direct seeded rice reduced GHG emissions by 17% in comparison with conventional transplanting. In northern Vietnam, on-farm experiments showed early plus midseason drainage reduced GWP by 42-66% than continuous flooding.<br><br>Adoption of Smart-valley technology increased rice yield by 0.9 t/ha and the net income by US$ 267 /ha. In Vietnam, the use of 1 Must 5 Reductions (11M5R) reduced the production costs by 23% reducing the production by 203 US$/ha per season, and generating 19% additional income, 175 US$/ha more.<br><br>Rice-fish farms generated 100 US$/ha more income than the comparison group among rural households in Central Dry Zone and Ayeyarwady Delta in Myanmar. |
| **Enabling actions** or strategies to achieve the stated results | Market incentives assessed; engaging market actors, business model development, involving women and youth; policy advocacy; capacity development; involvement of partners in technology development; out scaling mechanisms/tools developed; products are introduced to well-targeted domain and partners; products are gender-sensitive understanding of farmers | While FP3 have significant achievements as showcased above, it is not clear from the evidence presented in the annual reports (and elsewhere) as to where market incentives, private sector engagement, policy influence, involvement of partners and capacity building has worked out well and where performance on enabling actions has been weak. This analysis is important to understand what has been achieved in terms of ambitions for scale up and which priority sites or countries require further investments. This holistic understanding can lead to identification of barriers to scale (including capacity-related barriers). Even though CoA and flagship leaders understand these issues in-depth, this requires wider reflection and documentation so as guide the program of work for the remainder of the CRP timeframe. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | preference and adoption constraints; development and measurement of environment sustainability; proper technology setting; gender-differentiated needs assessment | |
| **Risks and assumptions**, during result-transitions in the theory of change | Market incentives not in place (outcome to impact); value chain actors, including women and youth, do not become involved (output to immediate outcome); no credit access especially for women and youth (immediate outcome to outcome); supportive policies not in place (outcome to impact); manufacturers for machineries not in place (immediate outcome to outcome); extension workers and development partners do not disseminate products; are insufficiently aware of gender inequities (output to immediate outcome); no effective scaling out mechanism and tools (output to immediate outcome) | The flagship team should reflect on assumptions made and risks experienced between 2017–19 and identify strategies to address some of the barriers to its work to achieve better impact. |

Flagship 4 in RICE has spent 9 million USD annually (on average). Given the fundamental nature of FP4, it would need to be assessed differently as conventional theory of change logic of achieving outcomes and impact may work differently here. The reviewers have taken this into account while assessing 'quality of science' and 'effectiveness' of FP4 research. A detailed analysis of RICE progress on FP4 Theory of Change is presented in Table 10.

***Table 9. Assessment on the RICE Flagship 4 Theory of Change***

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Discovery research**/activities | Global rice array, phenomics tools, crop models, data pipelines | FP4 is designed to conduct multi-disciplinary foundational research, involving several CG centers. FP4 intends to design tools for addressing future scenario of climate change and agroecological systems. |
| **Product**/research outputs | Plant ideotypes; improved crop management; QTLs/genes; selection protocols | FP4 has accomplished about half of its planned milestones while the remaining half have seen delays or have required readjustments. This has happened due to internal staffing and other constraints faced by the FP4 team.<br><br>Several of FP4's phenotype work has been accomplished successfully e.g. phenotyping facilities and network are up and running in at least 60% of the target sites with efficient |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | | reporting (data acquisition, quality control, annual reports, etc. Mechanisms/tools are in place. Value has been added to candidate genes from Global Phenotyping Network GWAS through postGWAS analyses with data curated. Furthermore, FP4 has completed spatial distribution of pests and diseases and deployment of available isolines completed in at least 60% of the target sites. FP4 has developed a rice data hub for data curation and integration modules.<br><br>Several planned milestones were not achieved such as - spatial distribution of pests and diseases and deployment of available isolines completed in at least 60% of the target sites (2017); global array refined based on preliminary results to capture major TPEs (target populations of environments of breeding programs) and major climate trend scenarios (2018); antenna experiments have generated quality data (environment and crop) from at least 80% of the global array sites (2019); global array delimited, baseline information including gender mapping (FP1) and historic climate and crop performance data gathered for crop-model assisted constraint mapping (2017) |
| **Adoption**/immediate outcome or research uptake | Climate change adaption options for rice breeding; new rice variety (FP5); improved policies and markets to support adoption (FP1); seed systems to deliver quality seeds to farmers (FP1) | While no specific 'product' has been delivered so far, FP4 has made progress on developing new climate-smart rice varieties, by establishing a global array composed of 25 sites and 71 varieties. This Magic Indica Panel was evaluated in 6 sites across Africa, Asia, and Latin America. FP4 characterized over 7,000 irrigated breeding lines for some disease resistance genes e.g., BLB (xa3, xa5 & xa13) and Blast (pi2 & pi9) using a 10-panel SNP chip specific for Africa. Overall<br><br>FP4 has established collaboration among IRD, CIRAD, and IRRI in RICE, which was instrumental in the quick turnaround in building improved bioinformatics infrastructure (GIGWA, Galaxy). This work benefited from CGIAR partnerships facilitated by the CG Platforms/Projects, particularly EiB, Big Data, and the Genomic Opensource Breeding Informatics Initiative (Cornell-IRRI-CIMMYT-ICRISAT). |
| **Outcome** | Large scale adoption; Increase productivity | Too early to expect progress on this from the FP4 research. |
| **Impact** | Increased resilience of the poor to climate change and other shocks | Too early to expect progress on this from the FP4 research. |
| **Enabling actions** or strategies to achieve the stated results | Expand geographic coverage; Expand genetic diversity, genetic selection, improve analysis tools; Identify new traits and genes by exploring new genetic resources | While FP4 has undertaken enabling actions as highlighted in the Theory of Change, its performance was slow during the period of review largely due to internal staffing and other challenges it experienced. FP4 being a fundamental research would need to create strong conviction around its work as donor money and priorities are shifting more towards applied research and innovations. |
| **Risks and assumptions**, during result-transitions in the theory of change | Inadequate trait or gene for climate change adaptation (input to output); Ideotypes are inaccurate (inputs to outputs) | The flagship team should reflect on the assumptions made and risks experienced between 2017–19 and identify strategies to address some of the barriers to its work to achieve better impact. |

Flagship 5 in RICE has spent 21 million USD annually (on average). FP5 is the most favored RICE flagship in terms of investments and priorities. In times of budget uncertainties, FP5 budgets were protected.

Even then, overall uncertainties did create an impression of instability leading to turnover of several flagship scientists. A detailed analysis of RICE progress on FP5 Theory of Change is presented in Table 11.

***Table 10. Assessment of the RICE Flagship 5 Theory of Change***

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| **Discovery research**/activities | Genetic diversity, target traits and genes, precision breeding tools, nutrition quality | FP5 effectively delivered most of its research activities. |
| **Product**/research outputs | Improved rice germplasm: New variety released in country | FP5 have several accomplishments in this phase of the CRP. Breeding programs have been updated over GRiSP, with a 5% yield gain. Between 25-50 new rice varieties for intensive system have been created and nominated for release with 15% higher yield, meeting national quality requirements. It has developed models and computational methods to characterize inter(sub) specific mosaic structure of rice genomes and its impact on traits transmission. It has assessed genes conferring tolerance of submergence, stagnant flooding, salinity, high/low temperatures, iron toxicity, drought, and blast conferred to elite backgrounds with initial elite lines nominated for release. It has validated 25 genes for C4 photosynthesis. Based on GRiSP results, it has analyzed and identified new breeding tools and resources for precision breeding gene editing, genomic selection, breeding simulations, candidate genes (20), markers (16).<br><br>CIAT is working in collaboration with AfricaRice. Lines from the CIRAD-CIART breeding work in Colombia were tested by AfricaRice in 2017–19 and were found to be superior to the local improved check.<br><br>In this phase of the CRP, FP5 has shifted its focus towards nutritious rice by estimating consumer values for grain quality traits and food products. It is developing nutritious rice with 20-22 ppm zinc content. FP5 is developing novel tools and processes to capture specialty traits developed at key action sites to minimize chalk, enhance head rice recovery, capture cooking quality.<br><br>Overall, FP5 research on modern rice breeding technologies are based on evidence of direct response to demand of rice value chain stakeholders. |
| **Adoption**/immediate outcome or research uptake | Seed systems deliver quality seeds to farmers | FP5 continued to produce high yielding breeding material and releases across target geographies in favorable, irrigated systems globally. Thousands of new breeding lines were generated, and hundreds of more advanced lines were tested and advanced towards variety release. Mainstreaming high zinc content in irrigated breeding targets was initiated.<br><br>FP5 has engaged with a range of private and public sector partners to promote direct seeded rice in Asia as an efficient and cheaper method of growing the crop through the creation of DSR consortium.<br><br>IRRI has started consolidating its market and value chain research through the concept of "digital product profiling," which aims at bringing together several layers of forward-looking data with the aim of developing market-driven, climate-resilient and gender-responsive product profiles for rice breeding. Secondly, IRRI initiated a novel research portfolio on the economics of rice |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | | breeding with the aim of providing evidence in support of the global adoption and impact of accelerated breeding technologies.<br><br>Despite several accomplishments, seed system work would require greater attention than what has been possible within existing arrangements of flagship-CoA and funding allocations. Seed systems in Africa being rudimentary and RICE so far has managed to impact on a small scale. Varietal adoption rate continues to be low, for example submergence tolerant variety in India (Assam) and Bangladesh is not adopted in farmers' fields on a wide scale. |
| **Outcome** | Large scale adoption; increase productivity | In 2018, FP5 completed the 10-year Stress-Tolerant Rice for Africa and South Asia (STRASA) Project. The project aimed to develop and deliver rice varieties with improved tolerances of abiotic stresses for smallholder farmers in the South Asian and African regions. The project's key achievements include the production and distribution of over 500,000 tons of stress-tolerant seeds to an estimated 18 million farmers, and the establishment of robust platforms for varietal knowledge enhancement, training, national and regional networks for product evaluation, seed production, and delivery.<br><br>In 2017 CIAT reported that 52% of the total rice acreage is under CIAT improved varieties with an annual increase of the adoption rate of 2.7%. Only through genetic improvement the adoption of CIAT varieties increased rice yields by 15%.<br><br>In 2018, as part of Green Super Rice (GSR) project, and in collaboration with the Chinese government, IRRI developed a mix of over 500 rice varieties and hybrids that perform well with fewer inputs and provide multiple tolerances from biotic and abiotic stresses. The project introduced inbred and hybrid GSR varieties in over eleven countries in Asia and Africa, with more than two million hectares devoted to these climate smart cultivars. |
| **Impact** | Increase profitability of farming; Mitigation and adaptation achieved; Improve diets for poor and vulnerable people; More sustainably managed agro-ecosystems | The flagship has performed well in this area. As reported in RICE annual reports, the STRASA project led to an increase in profitability and other benefits to about 8 million farmers. This result is reported in 2017 but is largely a legacy project even though it finished during the current phase of the CRP. Green Super Rice project has reported benefits of 59 improved rice varieties covering over two million hectares in 11 countries in Southeast Asia, South Asia, and East and Southern Africa. |
| **Enabling actions** or strategies to achieve the stated results | Support favorable policy development and market linkages (FP1); integrated seed system development with partner identification and capacity building along with policy engagement and variety promotion; gender awareness training (FP1); Develop and disseminate improved agronomy practices for new varieties (FP 2, 3); strengthen | The key to success of the varieties released by the flagship is private sector engagement for upstream research and for seed systems. RICE have moved strongly in this direction though more could have been done in terms of improving seed systems in Africa. RICE continues to improve collaboration with the private sector in multiple countries, with support from USAID and BMGF, with seed providers, multipliers, and marketers, decreased the time to scale considerably.<br><br>BMGF funding of 18 million USD for healthier and nutritious rice (from 2017) is likely to enhance RICE work in the nutrition space.<br><br>FP5 developed new opportunities to partner with private sector companies on the development of accurate markers. IRRI has set up a joint laboratory in Beijing, China, with the Chinese Academy of Agricultural Sciences to jointly research enhanced rice photosynthesis. IRRI also opened a joint lab at Jiangsu Academy of Agricultural Science to work on rice diseases. |

| TOC element | Description as per ToC of the RICE proposal 2016 | Reviewers' reflection *(assessment based on data from several sources – ARs, pub., OICRs, dashboards, MARLO/CAS analysis, key informant interviews)* |
|---|---|---|
| | capacity and partnership to develop evaluation network and data management (FP 1 and 4); Rice plant breeding capacity building; 50% inclusion of women in needs assessment, PVS and market survey (FP1); trait development guided by value chain needs, women farmer needs, women consumer's needs, overall market demand, nutrition needs (FP 1 to 3); Identify new traits and genes by exploring new genetic resources and partnerships (FP 3 and 4) | Corteva Agriscience™, Agriculture Division of DowDuPont and IRRI signed a multi-year framework agreement on collaborative rice research, deployment of new breeding technologies, and development of breeding programs. The shared goal for this partnership is to help rice farmers to become more productive and sustainable. The collaboration will offer farmers a broader suite of high-performing products and effective science-based innovations that will optimize yield and crop quality. |
| **Risks and assumptions**, during result-transitions in the theory of change | Unfavorable policies and non-functional markets (outcome to impact); Weak national seed system; limited involvement of private sector; seeds do not reach women farmers (immediate outcome to outcome); Inappropriate agronomy and crop management for new varieties (output to immediate outcome); Weak testing network and /or poor data management (output to immediate outcomes); Limited national plant breeding capability (inputs to outputs); Traits do not fit market and /or women farmers and consumers' demand (including quality and nutrition) (input to output); Inadequate trait or gene (input to output) | The flagship team should reflect on assumptions made and risks experienced between 2017–19 and identify strategies to address some of the barriers to its work to achieve better impact. |

Further ToC achievements are indicated by the OICRs, presented in Table 12.

***Table 11. Analysis of outcomes (as reported in the OICRs) contributing to broader goals on the ToC***

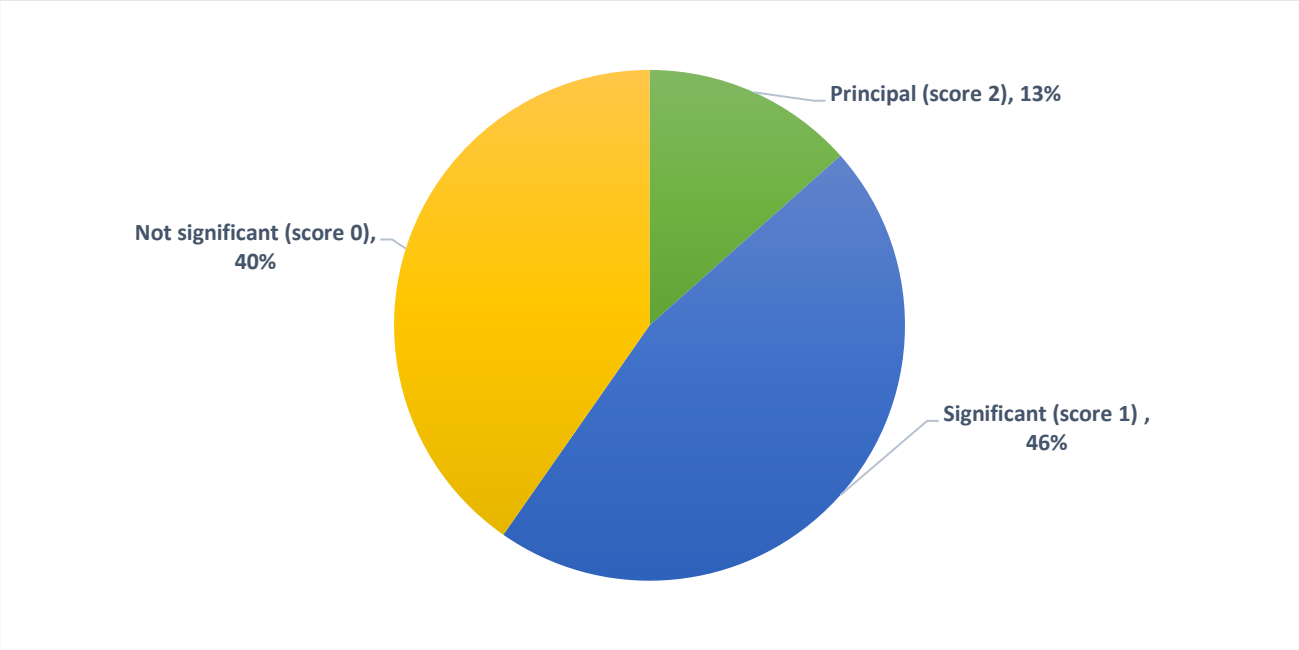
| Outcome and Impact Case | Reported impact evidence by OICRs | Reviewer's Remarks |
|---|---|---|
| Impact of improved rice varieties in sub-Saharan Africa (2017) | By 2014, the adoption of improved rice varieties by farmers in the studied countries was estimated at 3.5 million ha, including 1.4 million ha with NERICA varieties. About 1 million households totaling 8 million individuals, and 0.9 million households totaling 7.2 million individuals in SSA have been lifted out of poverty and food insecurity, respectively, in 2014 | This is legacy work, related to impact achieved by 2014, even though reported through a publication in 2017 |
| Adoption of alternate wetting and drying (AWD) in Asia (2019) | AWD has been integrated in major national rice crop management guidelines in Vietnam, China and the Philippines. Several rice-producing countries mention AWD in their contributions to the Paris Agreement as effective mitigation instrument in the agriculture sector. | AWD is widely promoted by several national/international actors and so the impact achieved cannot be solely attributed to RICE. Contributions are made by many other actors who have worked for dissemination of this technology. Several sources of evidence cited by the OICR establish cost-effectiveness of AWD adoption. Evidence presented does not indicate whether AWD is adopted on a wide scale. |
| Adoption of Rice Crop Manager in Philippines (2018, updated 2019) | In Philippines, more than 1.7 million recommendations generated for farmers in 2014 to 2018. Twenty-five percent of respondents have taken up recommended practices from RCM and benefit by 640 kg additional yield and US$ 213 added net return per hectare per season more than those who have not taken up the recommended practices.<br>In Orissa, the data generated from crop cuts show a yield gain 0.5 to 1 ton and US$ 155 added net return per hectare per season from plots where RCM recommendations were followed over that of farmers' fertilizer practice plots. | Impact data presented as evidence in this OICR seems to be generated from demonstration plots and it is not clear how many of farmers (beyond demonstration farmers) have adopted recommendations and what benefits have they realized.<br><br>Furthermore, it is reported that in 2018, in Vietnam, Indonesia, Bangladesh, and Bihar and Eastern UP, India, apps were developed and ready for release but required funding support for implementation. There is no update available on scale up of this work. |
| Adoption of '1 Must Do - 5 Reductions' rice management practices in Vietnam (2018) | The economic model had estimated 425,000 hectares for adoption nationally by 2016, for a benefit of US$ 27 million for the period 2013 to 2016. | This is legacy work which continues to see higher levels of adoptions and impact. The OICR concludes with the statement that 'possible strategies are needed to increase adoption of more sustainable crop management practices in the Mekong Delta'. |
| RiceAdvice improved the livelihood of smallholder rice producers in Nigeria (2019) | A recent impact assessment (2018) using randomized control trial in Nigeria showed that RiceAdvice increased yield by about 0.5 t/ha and net income by US$ 212 per hectare. More than 90% of the users of RiceAdvice services said that they would be willing to re-use it the subsequent season. About 80% of the farmers attributed three main advantages of RiceAdvice: increased yield, increased income, and reduced use of fertilizer (Arouna et al., 2019, listed as 1st reference). | The evidence presented in this OICR shows that addressing constraints to scale-up and scale-out of RiceAdvice would require: (i) improving access to financial services and input supply services through partnerships with various stakeholders, (ii) identifying and testing business models and (iii) establishing a targeted dissemination approach, which includes working with female service providers to reach female farmers. |
| Novel rice varieties for drought, flood prone and coastal saline rice ecosystems in Bangladesh | The released rice varieties IR11T160, IR11T183, Salinas 27 and 28 are suitable for coastal saline ecosystem in Bangladesh, high yield, tolerance to coastal salinity good grain quality. The lines produced 3.0 and 2.9 tha-1 under saline conditions and 6.1 and 4.7 tha-1 under normal conditions, respectively. Bahuguni dhan 1 and Bahuguni dhan | The varieties (IR11T160, IR11T183, Salinas 27 and 28 in Bangladesh and Bahuguni dhan 1 and Bahuguni dhan 2 in Nepal) are released with high yield and stress tolerant potential. However, there is no evidence on their adoption so far. |

| Outcome and Impact Case | Reported impact evidence by OICRs | Reviewer's Remarks |
|---|---|---|
| and Nepal (2019) | 2 suitable for the flood and drought-prone ecosystem. The released varieties are available for uptake by seed systems for dissemination in Nepal. | Seed system and scaling pathways would require further attention. |

# Annex 11: Gender Analysis

The RICE CRP has demonstrated gender inclusiveness across all flagships and at four levels of results of its Theory of Change. In close to 60% of research outputs delivered by RICE, gender is an important consideration, either as a principal or a significant component of the output delivered by the CRP.

***Figure 7. RICE's work on gender: Proportion of gender-sensitive outputs (2017–19)***




Results from our gender analysis (see Table 12) indicate that, on this front, RICE has performed well on all four of its Theory of Change results levels. Just like a funnel, RICE started with a large number of activities in the 'discovery research' level leading to some pilots, however very few of those pilots are going forward in terms of wide scale adoption as well as being used for gender-related outcomes. Evidence on all these results has been harvested from multiple data sources to indicate that the RICE achievements on gender mainstreaming are commendable. The analysis in Table 12 (see reviewers' remarks) also indicates several areas where RICE can strengthen its gender work and impact.

***Table 12. Analysis of RICE work on gender***

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Discovery research**/activities | • Measures of women empowerment quantified using WEIA (FP2)<br>• Gender-youth business models in rice value chain reinforced (FP2)<br>• Development of 13 product profiles enabling rice breeders to make their variety replacement programs more market-driven, gender-inclusive and climate-resilient (FP2, FP5)<br>• Research established that the households where women participate in the decision process to select rice varieties, are more likely to adopt modern varieties (FP1)<br>• Research established that women entry into the Rice Value Chain is constrained by high initial capital requirements (FP1)<br>• New business ideas and new employment opportunities identified for women and youth in Nigeria (FP2)<br>• Benchmark indicators established for women farmers' labor use at seven action sites (FP2) | Discovery research is rightly pitched at identifying business models, diversification and value chain opportunities that would work for women. |
| **Product**/research outputs | • Piloting innovative business models on emerging opportunities for women and youth in the rice sector in selected countries in two countries in Asia and Africa each (FP2)<br>• 250-300 scholars (30% women) enrolled in advanced degree training (bachelors, masters, PhD) (FP1)<br>• Postharvest technologies designed for increasing women's incomes and options and reducing drudgery of work. Rice parboiling in Africa is the example. (FP3)<br>• Prototype labor-saving technologies for crop establishment and weeding, harvesting, and threshing introduced for testing at seven action sites - Motorized weeder and drum seeder were tested in Côte d'Ivoire. Prototype fertiseeder was developed and tested. The fertiseeder was modified based on the suggestions of the farmers and tested in Madagascar<br>• Diversified enterprise opportunities for women (FP3)<br>• A total of 19,756 farmers of which 2043 women received RiceAdvice recommendations and guidelines to cover 12,796 ha in Nigeria, Burkina Faso, Mali, Senegal (FP3)<br>• Labor use efficiency and women empowerment indicators in the Sustainable Rice Platform (SRP) Performance Indicators (FP3) | Only a limited set of activities that were 'discovered' to improve women participation in RICE value chain were taken forward towards piloting and capacity development. Limited resources available (and associated financial uncertainties) might have contributed to low number of pilots and upscaling actions. Upscaling would require appropriate partnerships to address identified constraints such as access to finance for women entrepreneurs to play a strong role in the rice value chain. |
| **Adoption**/immediate outcome or research uptake | • Sufficient commercial seed produced by the seed system to provide seeds for at least 5 million farmers, of which at least 50% are women, at the key action sites (FP1, FP2)<br>• Nearly 5000 women farmers managed demonstration clusters for several stress-tolerant varieties in Eastern India, closely related to quality seed production (FP1, FP5)<br>• Rice market value captured by women scale processors increased thanks to the improved parboiling system introduced for rice products diversification in Cote d'Ivoire (FP3) | Evidence suggests that seed production and GEM parboiling appear to be the most promising business models for women. Further analysis into other promising avenues (prototype labor saving technologies, post-harvest technologies etc.) that were not adopted for scale-up is required. It is also important to look into what more needs to be accomplished by RICE in the remainder of the CRP timeframe. |

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Outcome** leading to impact | • Women entrepreneurs in agricultural mechanization was developed in Bangladesh. The landless poor who used to harvest paddy manually were provided services on harvesting paddy by reaper leading to improved livelihoods with higher income (USD392-503 per year) than before (USD45-114 per year). (FP3)<br>• In Nigeria, the GEM Parboiling technology installed in Lafia Innovation platform coupled with training of over 1,200 actors had multiple benefits; (i) produced a cleaner and higher-quality product resulting in 50% increase in price above that of traditionally parboiled rice, (ii) reduced wood consumption by 40% and the exposure of the users to smoke and heat compared to the traditional parboiling, (iii) was less time-consuming and safer to operate - particularly for female and younger processors. parboilers that use the GEM technology make at least an extra 82 USD on every ton of rice parboiled compared to parboilers using the traditional system (FP3) | Strong gender outcome evidence is available on agriculture mechanization in one country and on GEM parboiling in another country. These are clearly significant gender outcomes achieved by RICE during 2017–19. As demonstrated above, RICE have ample technologies and business models where gender outcomes can be improved. Also, RICE can aim to deepen its impact by spreading the successful technologies in one country to other countries where the specific technology would be contextually relevant. |

**This nomenclature is derived from the RICE Theory of Change (ToC). 'Discovery research' corresponds to research activities; 'Product' corresponds to research output; 'Adoption' corresponds to research uptake; and 'Outcome' corresponds to development outcome subsequently leading to impact. These definitions are used throughout the ToC analysis, gender analysis, youth analysis, climate change analysis, capacity development analysis, nutrition analysis, innovation analysis etc.*

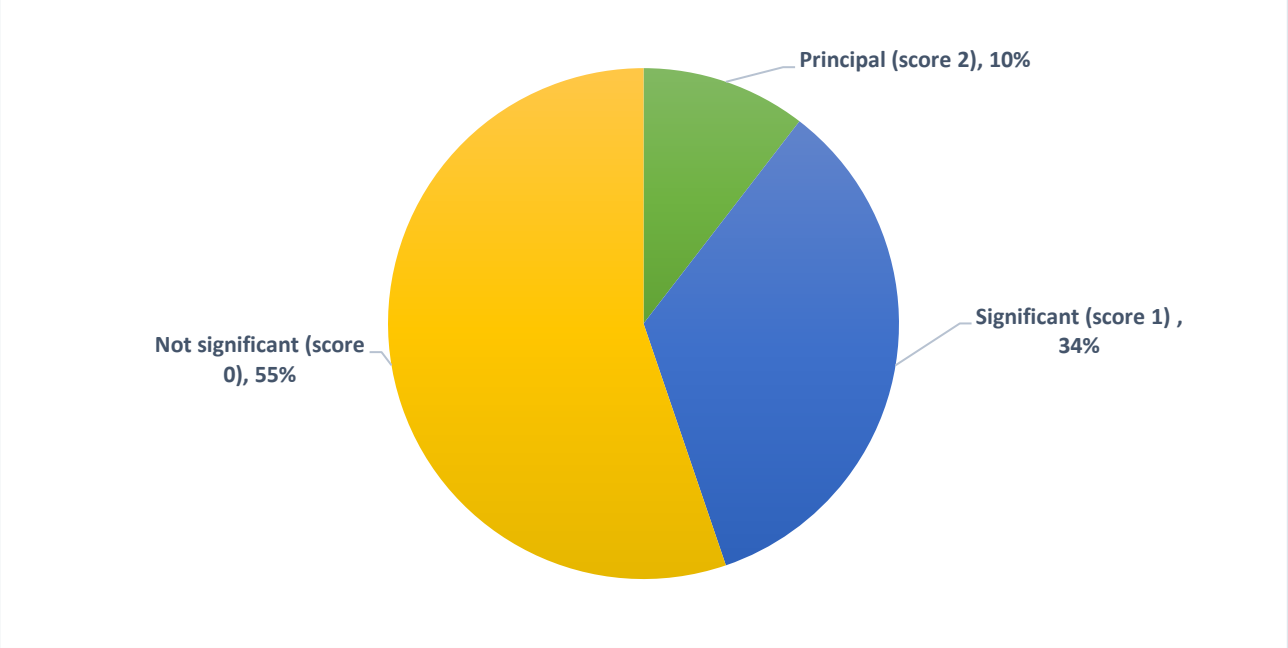
# Annex 12: Youth Analysis

There are strong drivers behind engaging youth in the RICE CRP. These are:

- An increasing number of unemployed youth
- An increasing number of youth moving out of agriculture who would likely be attracted to alternative economic opportunities in RICE agri-food systems
- Viable entrepreneurial opportunities that can engage youth in a productive manner

This review finds that youth programming in RICE is still nascent. Lack of resources is cited as one of the reasons by the RICE team. RICE has allocated resources to youth programming only in the last year and consequently a youth strategy has been developed. This strategy is likely to guide future actions and mobilize funds for achieving appropriate programming.

***Figure 8. Youth significance in RICE: Proportion of outputs representing youth in RICE (2017–19)***




In almost half of research outputs delivered by RICE, youth is an important consideration, either as a principal or a significant component (see Figure 8). Results from an assessment of RICE work on youth in Table 13 (see reviewers' remarks) indicate several areas where RICE can strengthen its youth work and impact. Evidence on all these results which has been extracted from multiple data sources indicates that RICE's achievements on youth programming are 'marginal'. It is not evident whether any 'adoption' or 'outcome' level result is being achieved by RICE on youth.

***Table 13. Analysis of RICE work on youth***

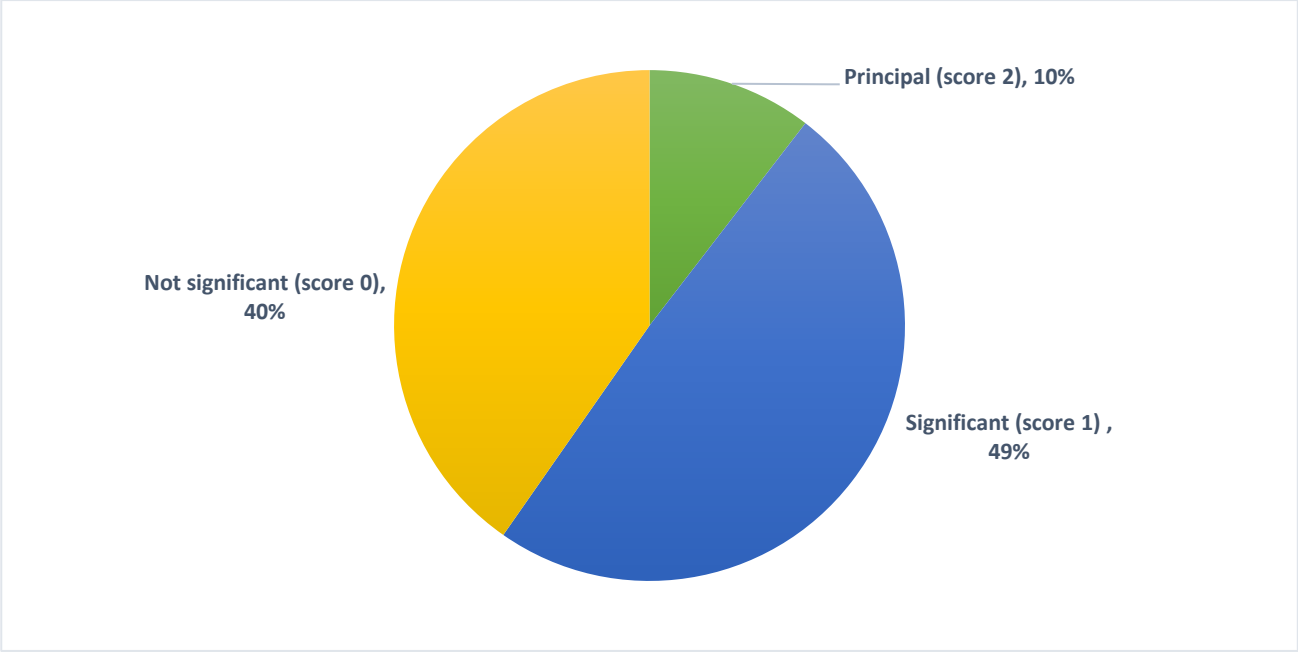
| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Discovery research**/activities | • Gender-youth business models in rice value chain reinforced (FP2)<br>• Opportunities for youth engagement in agribusiness services provision identified along the rice value chain in Côte d'Ivoire. (FP2)<br>• Research established that youth are poorly represented in different service provision units as owners (<10%) and are just employees (about 80% of staff in different units). Youth entry into the rice value chain is constrained by lack of finance, lack of improved equipment and negative perception of youth in agriculture (FP2) | RICE identified several ways in which youth can be better targeted and benefited in the value chain. This was necessary and more could have been achieved. |
| **Product**/research outputs | • 103 youth business plans were developed - 52 business plans for Senegal and 51 for Mali representing 38% female and 62% male. This was done to promote youth employment in the rice value chain within the PEJERIZ project (FP2)<br>• Training in the use of RiceAdvice in 2017; 54% of trainees were youth (FP3) | Digital agriculture (RiceAdvice, Rice Crop Manager, RiceDoctor) present a potential business opportunity for youth as an agri-entrepreneur by becoming service providers to fellow farmers. RICE can explore such opportunities for scaling its innovations. |
| **Adoption**/immediate outcome or research uptake | • 120 youth seed entrepreneurs trained by AfricaRice in Ibadan. Tangible achievements include selling seeds to off-takers (Reza Agro Services in Akwa Ibom State) (FP2) | RICE faced the challenge of appropriately engaging youth in specific business models/entrepreneurship activities given the lack of finance, equipment and business development support that would be required. RICE would need to address these constraints through appropriate partnerships. RICE can also learn from the agribusiness incubator program run by ICRISAT/GLDC. |
| **Outcome** leading to impact | | Youth level outcomes/impact are not evident from RICE so far. |

* *This nomenclature is derived from the RICE Theory of Change (ToC). 'Discovery research' corresponds to research activities; 'Product' corresponds to research output; 'Adoption' refers to research uptake; and 'Outcome' corresponds to development outcome subsequently leading to impact. These definitions are used throughout the ToC analysis, gender analysis, youth analysis, climate change analysis, capacity development analysis, nutrition analysis, innovation analysis etc.*

# Annex 13: Analysis of Capacity Development and Partnerships

The RICE CRP has demonstrated its emphasis on capacity development and partnerships across all flagships and all four levels of results laid out in its Theory of Change. Capacity development is an important consideration, a principal or a significant component in close to 60% of research outputs delivered by RICE.

***Figure 9. Significance of capacity development in RICE: Proportion of outputs representing CapDev in RICE (2017–19)***




RICE has carried out short-term trainings for next users ((in innovation platforms, policy workshops) and end users (on farm trials, farmer field days). As per dashboard data, RICE has conducted short-term trainings for 183,163 participants, of which 40% are female. RICE has provided long-term training through its Scholars program, covering Bachelor, Masters and PhD courses. During 2017–19, a total of 1566 scholars have been trained, of which 51% are females.

Partnerships are key to RICE, both for discovery and delivery science. The uniqueness of the RICE CRP lies in its collaboration with CG and non-CG centers as core partners. CIRAD, JIRCAS and IRD have brought in their advantage and experience in Africa and created shared resources across the centers. RICE engaged in several partnerships including:

- **Academic institutions:** Cornell University, Makerere University, University of Illinois USA, University of Saskatchewan Canada
- **Advanced research institutes:** Texas Tech University, NIAS-Japan; University of Adelaide-Australia
- **Governments:** Departments of agriculture in several countries including Philippines, Vietnam, India (state and central levels), Myanmar
- **National agriculture research systems (NARS)**: Africa-wide Agronomy Task Force, University of Parakou, Benin; Institut national des recherches agricoles du Benin; National Cereals Research Institute, Nigeria; Nassarawa Agricultural Development Program; Kano Agric. & Rural Dev. Authority; Nat. Agricultural Ext. Research & Liaison Services; Centre National de Recherche Agronomique, Cote d'Ivoire, DICTA- Guatemala, INTA-Nicaragua, IDIAP-Panamá
- **National agriculture research and extension systems (NARES)**: Disease testing network, Embrapa
- **Non-governmental organizations:** FOFIFA (Centre National de Recherche appliquée au Développement Rural, Madagascar)

- **Private companies**: Sarmap, Trimble, LEHNER, Fedearroz-Colombia, GrainPro, ACI Seeds
- **Regional organizations**: ECOWAS, West African Monetary and Economic Union (UEMOA), African Development Bank
- **Global organizations or platforms:** Sustainable Rice Platform, Direct Seeded Rice Consortium, FLAR

In a typical year, RICE would be working with more than 375 such partners. Given the diversity of partnerships, capacity development requirements, the approach is likely to be different. One of the enabling actions proposed in the RICE ToC is that 'RICE would adopt the CGIAR capacity development framework as a comprehensive structure to systematically strengthen capacity among partners and actors along its impact pathway'. The critical thinking and actions on the CGIAR capacity development framework for different countries is not reflected in the RICE annual report or other related documents. NARS and NARES are key RICE partners, each with different capacity development needs. While several capacity development actions have been taken, it is not evident whether these were based on holistic understanding of capacity barriers that exist for different NARS/NARES for achieving success in specific initiatives. For example, as technical collaborators, NARS in Africa expect a hands-on capacity development approach from the RICE CRP while the NARS in Bangladesh or India expect continued relationship with RICE to facilitate increased government or donor investments in building infrastructure and national capacities.

Overall, analysis of available evidence indicates that RICE should review its capacity development framework to make it more context specific as requirements of NARS in Africa and those in Asia are very different now. RICE can play more of a facilitator role with some NARS in Asia as they are more likely to require more capacity for their own research and development. RICE can play a broker/knowledge management and knowledge sharing role rather than a researcher or implementer role in some NARS in Asia and Africa. RICE can however continue to lead on research and innovations in other NARS in Africa. Collaboration with NARS should start from the very beginning of a research project. As is well known, NARS in a country better understand the context and their government needs. Identifying champions within NARS and collaborating with them can be beneficial.

In the ongoing phase of the CRP, RICE realized that many countries do not have the appropriate public systems for disseminating new varieties, and so working with the private sector has been crucial. The CRP has learnt how to engage with the private sector in terms of offering IP or other incentives. This is one of enabler of CRP success in countries such as India, Bangladesh, the Philippines, and Vietnam. Private sector engagement and capacity building would need to be further enhanced in the remainder of the timeframe of the CRP.

Further assessment of RICE work on capacity development and partnerships indicates that RICE has performed well till the 'adoption' result level as per the ToC. To progress further to the 'outcomes and impact' level, RICE would need to enhance, a) type of partnerships e.g. more private sector engagement is needed and, b) capacity development framework e.g. in terms of identifying capacity related barriers to success in specific context and with specific collaborative work with partners. The analysis in Table 14 (see reviewers' remarks) also indicates several areas where RICE can strengthen its partnership and capacity development to achieve better impact. A summary assessment of RICE on the four result levels of the Theory of Change is provided in Table 14.

***Table 14. Analysis of RICE work on capacity development and partnership***

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Discovery research**/activities | • 250-300 scholars (30% women) enrolled in advanced degree training (bachelors, masters, PhD) (FP1)<br>• Capacity development needs on sustainable farming systems identified among partner research organizations (FP3) | There are two types of 'discovery' research needed here: 1) Discovery of program needs for research, scaling and policy influence so that appropriate partners can be identified; 2) Discovery of capacity development needs of selected partners for addressing barriers to success of collaborative work and partnerships. RICE has done well in the first discovery and less well in the second discovery. It is evident that RICE has engaged with a large number of partners but it is less evident whether specific capacity development barriers in different contexts and with different partners were identified and/or addressed. |
| **Product**/research outputs | • Establishment of a formal Economic Rice Observatory to provide policy briefs to the FLAR member countries (FP1)<br>• Functional multi-stakeholder platforms at key action sites. Well-functioning multi-stakeholder innovation platforms with active local IP coordination and facilitation teams in Nigeria, Benin, Uganda, and Madagascar. IPs have also been initiated in Senegal, Ghana, and Cote D'Ivoire and are being facilitated to refine their governance structures (FP1, FP3)<br>• IRRI Global Rice Model was updated and upgraded. A baseline was developed, calibrated, and projections were formulated on the global rice market (FP1, FP3)<br>• Collaboration among IRD, CIRAD, and IRRI in RICE, which was instrumental in the quick turnaround time in building improved bioinformatics infrastructure (GIGWA, Galaxy). (FP4)<br>• Agricultural knowledge service providers (extension workers, staff from development agencies, staff from universities, farmers, etc.) were trained in use of RiceAdvice (FP2) | The work of two flagships (FP2 and FP3) was instrumental in catalyzing partnerships and capacity development. Due to budget cuts, the work of these two flagships was more seriously affected than others. It is therefore likely that effectiveness of partnerships and capacity development of next users and end users of CRP science would be affected more than other aspects of the program. |

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Adoption**/immediate outcome or research uptake | • Nearly 5000 women farmers managed demonstration clusters for several stress-tolerant varieties in Eastern India, closely related to quality seed production (FP2)<br>• GEM (Grain quality enhancer, energy-efficient and durable material) related capacity building across several countries (FP3)<br>• Substantially contributed to enhanced capacity and knowledge of NARES on sustainable postharvest management practices such as flatbed drying, in-store drying, hermetic storage, rice husk furnace, rice straw management, etc. (FP2, FP3 through several bilateral projects) | Innovation platforms (farmer organizations, multi-stakeholder forums), public private sector partnerships (such as DSR consortium, CARD, FLAR) and various other strategies have served RICE well in improving adoption. Enhanced adoption would require strengthening of innovation platforms as well as increase in number of delivery partnerships. One estimate suggests that 25% of RICE's partnerships were delivery partnerships, while the remaining are research (70%) or policy partnerships (5%). |
| **Outcome** leading to impact | • In several countries (such as the Philippines, India, Vietnam, Myanmar), RICE has made inroads into the policy circles, delivering successes as compiled by this review<br>• Evidence amassed by RICE indicates that RiceAdvice, Rice Crop Manager and several other digital applications have led to capacity building among farmers and improvements in yield and income (FP3)<br>• Impact of Smart Valleys technology have been well documented (FP3)<br>• Diversified rice-based farming systems in Myanmar, including collaboration with WorldFish/FISH to increase net production of food and cash incomes of rural households in Central Dry Zone and Ayeyarwady. The project(s) had direct engagement with 3,500 farmers. Rice-fish farms generated 100 US$/ha more income than the comparison group (FP3) | Several successful public sector partnerships delivering impact have been formed. To achieve a greater degree of outcomes and impact, private sector engagement and capacity building would need to be further enhanced in the remainder of the timeframe of the CRP. |

* *This nomenclature is derived from the RICE Theory of Change (ToC). 'Discovery research' corresponds to research activities; 'Product' corresponds to research output; 'Adoption' corresponds to research uptake; and 'Outcome' corresponds to development outcome subsequently leading to impact. These definitions are used throughout the ToC analysis, gender analysis, youth analysis, climate change analysis, capacity development analysis, nutrition analysis, innovation analysis etc.*

# Annex 14: Analysis of Climate Change Research in RICE

All evidence amassed by this review strongly indicates that RICE has integrated climate change research into its programming. In that respect, RICE is a stand-out example of 'systems' research, while still focusing on a commodity. RICE has worked with CCAFS on several climate change research areas such as scaling-up of new climate smart technologies, stress tolerant varieties, protocols on water saving technologies, climate smart villages in the Mekong river basin, bridging the gap between science and policy, mitigating methane emissions in Vietnam and Bangladesh and a project on co-benefits of AWD. A summary assessment of RICE work on climate change on the four result levels of the Theory of Change is provided in Table 15.

***Table 15. Analysis of RICE work on climate change***

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Discovery research**/activities | • RICE established a global array composed of 25 sites and 71 varieties. The Magic Indica Panel was evaluated in 6 sites across Africa, Asia and Latin America. This has helped in developing new climate-smart rice varieties (FP4)<br>• Effects of climate change scenarios have been modeled in Africa (in the context of high temperatures). An agreement was signed between AfricaRice and Wageningen Plant Research to conduct crop modelling to explore adaptions to climate change for rice in Africa, including genetic adaptation traits and optimized sowing windows. In Latin America, climate change scenarios for Brazil were tested and showed the importance of Target Population Environment definition for upland rice breeding adaptation (FP3, FP5)<br>• Options for reducing risks caused by climate risks identified at six action sites (Senegal, Madagascar, Vietnam, Indonesia, Myanmar) (FP3)<br>• GHG emissions and carbon capture benchmarked at three action sites (FP3)<br>• "Digital product profiling," for bringing together several layers of forward-looking data with the aim of developing market-driven, climate-resilient and gender-responsive product profiles for rice breeding (FP1, FP5) | All cited examples of discovery research strongly indicate that RICE have integrated climate change research into the programming. |

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Product**/research outputs | • New QTLs/genes have been identified for tolerance to high temperature, drought, stagnant flooding, submergence, and tolerance to low radiation. At the same time, research has been also undertaken to better understand the effect of climate change on biotic stresses (diseases). The development of varieties for tolerance to multiple stresses (such as submergence plus drought, submergence plus salinity, salinity plus drought, drought plus high temperature plus cold at seedling stage, as well as varieties combining tolerance to abiotic and biotic stresses) will help to maintain yield under recurring occurrence of climate-related stresses (FP5)<br>• IRRI Global Rice Model was updated and upgraded. A baseline was developed, calibrated, and projections were formulated on the global rice market (FP1, FP3)<br>• ARICA 6, a climate smart variety is the future (FP5)<br>• Substituting wood for rice husk as fuel for parboiling (Mini-GEM parboiling) saves costs linked to wood purchase, reduces deforestation and greenhouse gas emissions. Utilization of rice husk furnaces is further found to reduce CO2 emissions (FP2)<br>• Developing and piloting several innovations in Asia such as rice husk furnace, rice straw furnace, rice straw feed, rice straw mushroom, LCA-rice straw, rice straw pelleting, and rice straw batch biogas production, sustainable rice straw management have potential to reduce CO2 emissions (FP2, FP3)<br>• Input use efficiency of improved practices assessed using sustainability indicators revised together with the Sustainable Rice Platform (FP3)<br>• Integration of options for reducing risks caused by climate risks communicated to national policy framework (FP1, FP3)<br>• RICE contributed to development of revised SRP version 2.0 which provides 41 guidelines in rice cultivation covering farm management, water use, pest management, nutrient management, harvest and post-harvest practices, health and safety, and labor rights (FP3)<br>• Direct seeded rice reduced GHG emissions by 17% in comparison with conventional transplanting. In northern Vietnam, on-farm experiments showed early plus midseason drainage reduced GWP by 42–66% than continuous flooding (FP3) | Several QTLs/genes, models, products, and technologies have been developed in RICE which have good potential for achieving climate adaptation and resilience and also contribute to climate change mitigation as well. |

| Result level as per ToC* | Achievement as reported by the CRP (flagship) | Reviewers' remarks |
|---|---|---|
| **Adoption**/immediate outcome or research uptake | • Remote sensing-based rice monitoring system in several countries (India, Philippines, Cambodia, Vietnam) leading to improved climate resilience and adaptation (FP1)<br>• Institutionalizing sustainable rice production guidelines in Vietnam, which can be considered as a first step in mitigating climate change in the rice sector with important spillover potential to other countries (FP2)<br>• A roadmap for adopting low-emission technologies in rice production including AWD-suitability maps for An Giang province. The Department of Crop Production under Ministry of Agriculture and Rural Development highly appreciated the mapping methodology and requested for IRRI's continued assistance in AWD scaling process in other Mekong River Delta provinces. Furthermore, IRRI developed a blueprint guiding national partners to plan, finance, and implement agricultural NDC. Supported by RICE and partners, the National Agriculture Extension Center, formally launched the training materials on climate-smart production (FP3)<br>• Impact of crop management practices on GHG emissions assessed in three key action sites consisting of (i) Eastern India, (ii) Mekong delta, Vietnam, and (iii) northern Vietnam. - On-farm assessment of different rice crop management practices in the Mekong Delta, Vietnam showed that improved - practices including alternate wetting and drying (AWD) water management reduced GHG emissions by 39% (FP3)<br>• Full GHG accounting of straw removed from the field will depend on the ensuing utilization of straw and the off-field emissions involved (Romasanta et al 2017). | RICE technologies are already being adopted, though most adoptions are site-specific so far and not at wide scale. These adoptions have clearly demonstrated the potential of RICE technologies for improving resilience and reducing greenhouse gas emissions. |
| **Outcome** leading to impact | • In collaboration with the Chinese government, RICE developed a mix of over 500 rice varieties and hybrids that perform well with fewer inputs and provide multiple tolerances from biotic and abiotic stresses. The project introduced inbred and hybrid GSR varieties in over eleven countries in Asia and Africa, with more than a million hectares devoted to these climate smart cultivars (FP3, FP5)<br>• Improved water efficiency and emission reduction due to RICE innovations such as AWD (FP3)<br>• In Nigeria, the GEM Parboiling technology reduced wood consumption by 40% (FP3) | Besides the China example, there is so far limited evidence of climate change research of RICE contributing to reduction of greenhouse gas emission in a large quantum. Potential is well-studied and established. Small scale adoptions as noted above have contributed to small scale outcome. Further dissemination and adoptions are likely to increase the quantum of impact. |

* *This nomenclature is derived from the RICE Theory of Change (ToC). 'Discovery research' corresponds to research activities; 'Product' corresponds to research output; 'Adoption' corresponds to research uptake; and 'Outcome' corresponds to development outcome subsequently leading to impact. These definitions are used throughout the ToC analysis, gender analysis, youth analysis, climate change analysis, capacity development analysis, nutrition analysis, innovation analysis etc.*

# Annex 15: OICR Analysis and Templates

*Review of OICR number 2710: Implementation of satellite-based rice monitoring system in the Philippines and in the states of Andhra Pradesh and Tamil Nadu of India*

*Why this OICR was selected:* This OICR was selected as this is a high-potential case, and a good representation of regional (South East Asia and South Asia) and global impact of RICE research innovations. The case is presented at level 2 (as per updated OICR in 2019), but the progress achieved in some countries (such as Philippines and India) indicate the contribution of RICE has advanced to level 3. A level 3 achievement is attainable in other countries (Cambodia, Vietnam, sub-national in India) as well, if suitable enabling actions are implemented.

*Overview of case*[6]

The Philippine Rice Information System (PRISM, https://prism.philrice.gov.ph/), a satellite-based rice monitoring system that provides seasonal estimates of rice area and yield, and assessment of crop loss in the event of flood or drought, concluded its R&D phase in 2018 and was completely handed over to the Philippine Department of Agriculture through the Philippine Rice Research Institute (PhilRice) who now fully operates PRISM. This is an example of collaboration between IRRI and government agencies towards the realization of the shared goal of creating and translating sound science into useful, practical innovations. PRISM is based on the projects RIICE (www.riice.org) and RSSP (another Philippine DA-funded project). This initiative is serving as a model for other countries in Asia, specifically Cambodia and Vietnam, where discussions on institutionalization of the technology are on-going. Using PRISM and RIICE technologies, there is increased awareness of NARES partners on potential technology contribution to support 'Pradhan Mantri Fasal Bima Yojana' crop insurance program in Andhra Pradesh, India. Increased capacity of NARES partners in operating satellite-based rice monitoring system for decision making and crop insurance program as demonstrated in Tamil Nadu India and Philippines (advanced and mature progress), Vietnam, and Thailand (medium progress), and Andhra Pradesh and Odisha, India (early progress).

**OICR analysis template**

CRP: RICE

| | | |
|---|---|---|
| **OICR number & title:** 2710 Implementation of satellite-based rice monitoring system in the Philippines and the states of Andhra Pradesh and Tamil Nadu of India (updated evidence) | | |
| Phases of report (new/updated same level/updated new level of maturity): Updated | | |
| If for Innovations at Level 4 or Policies at Levels 2 and 3 | | |
| Year reported: 2019 | Maturity level: 2 | # Years of programmatic work: 4 |
| Geographic location(s): India, Philippines, Vietnam and Cambodia | | |
| Populations covered, estimated size and socio-demographic categories (e.g., subsistence farmers, women, adolescents, etc.): Close to 300,000 farmers have benefited every year from insurance linked claims for which damage assessment data was provided by RICE partner to the insurance agencies in Tamil Nadu, India. | | |
| **Key contributors to the outcome** | | |
| CGIAR (FPs, other CRPs/Platforms and FPs, centers): Flagship 1, with connection to Flagship 2 (financial services to farmers) | | |
| **External partners**: **Philippines:** DA - Department of Agriculture<br>**India:** Tamil Nadu Agriculture University, Andhra Pradesh Department of Agriculture, Dr. (Smt) Poonam Malakondaiah, Special Chief Secretary; ANGRAU Acharya N.G. Ranga Agriculture University (ANGRAU), Dr. A. S. Rao, Director of Research, Odisha; Department of Agriculture and Farmer' Empowerment, Dr. M. Muthukumar, Director, Directorate of Agriculture & Food Production; Dr Rajesh Das Nodal Officer, Directorate of Agriculture and food production<br>**Cambodia:** Ministry of Agriculture, Forestry, and Fisheries, H.E. Dr Ngin Chhay, Director General of General Directorate of Agriculture; Dr Vang Seng, Director, Department of Agricultural Land Resources Management; Mr Yann Phanna, Deputy Chief of Bureau, Departement of Planning and Statistics | | |

[6] Source: RICE CRP OICR 2019 Annual report

| |
|---|
| **Vietnam:** Ministry of Agriculture and Rural Developement, Mr Nguyen Anh Minh, Deputy Director, International Cooperation Development; National Institute of Agricultural Planning and Projection, Nr Nguyen Quang Dung, Director<br>SwissRe, Mr Biggy Mguyen, Senior Client Manager |
| **Links to the CGIAR Strategic Results Framework: (IDOs and sub-IDOs)**<br>In this instance, RICE innovation (crop growth modelling and remote sensing technologies for crop monitoring) contributes to sub-IDO of 'enhanced institutional capacities in partner research orgnaisations'. This case also demonstrates RICE contributions to other sub-IDOs such as 'improved access to financial and other services', and 'conductive agriculture policy environment'.<br><br>And to the SRF 2022/2030 target:<br>• # of more people, of which 50% are women, meeting minimum dietary energy requirements.<br>• # of people, of which 50% are women, assisted to exit poverty |
| **[CRP] contributions to the outcome *(list any of the following)*** |
| Innovations: Integration of crop growth models with satellite, drone, and mobile based rice monitoring; integration of crop insurance with satellite monitoring data on rice. |
| Policies: The outcomes reported in this OICR is reported to have contributed to policy such as Rice Industry Roadmap Plan 2030 in Philippines |
| Key CRP publications supporting the OICR:<br>• There is no journal publication reference available in recent years, but several communication materials have been cited in the OICR published in 2017 and in 2019.<br>• 2017 - Release ASEAN Crops: Satellite technology expedites insurance payouts in India's crop insurance programme.<br>• 2017 Two Government Orders in Philippines provide robust evidence of the uptake /embedding of the innovation within the Government: 1. Creation of a Technical Working Group for the ICT support in the operationalization of PRISM; 2. Establishing the Philippines Rice Information System (PRISM) unit based at PhilRice<br>• 2014 publication – Legacy work but that contributed to development remote sensing based rice monitoring - Remote Sensing | Free Full-Text | Towards an Operational SAR-Based Rice Monitoring System in Asia: Examples from 13 Demonstration Sites across Asia in the RIICE Project (mdpi.com) |
| **OICR relationship with CGIAR cross-cutting issues** (YES/NO) |
| Capacity development: YES. Partners such as TN Agriculture University (TNAU), Department of Agriculture in Philippines have acknowledged contribution of RICE CRP towards individual and institutional capacity development. |
| Gender: While the OICR has listed no gender relevance, however because the farmers received insurance claims based on damage assessment done by RICE partners, it is likely to have significant (if not principal) gender impacts. This dimension has not been assessed though. |
| Youth: Same as Gender, the innovation is likely to have indirect positive impact on youth |
| **Organization responsible for OICR** (CGIAR/not CGIAR): RICE/IRRI |
| **External partners related:** TN Agriculture University in India |
| **Partnerships** Key partners ([CRP]'s engagement with each partner, and extent to which partner expectations/needs were met or not): |
| **Brief reviewer's description of the outcome (based on OICR report, documents cited, original data collected/interviews and other references)**<br>As is acknowledged by the OICR, the outcomes are more advanced in Tamil Nadu in India and in the Philippines and less so in Cambodia and Vietnam. A brief analysis (based on stakeholders' interviews and documented evidence) is presented below:<br><br>In Tamil Nadu (India) the State Government has widely adopted the technology for crop insurance. This has generated large benefits for close to 300,000 farmers on an annual basis as per one stakeholder interviewed. The Government of Tamil Nadu in India has stipulated that all insurance companies use the data provided by TNAU. This has ensured that RICE technology is used for crop insurance linked rice monitoring. This is a win:win solution for farmers as well as insurance companies who benefit in terms of receive reliable datasets related to damages for processing claims. It benefits the state government in terms of ensuring better implementation of crop insurance regulations and it benefits researchers (TNAU) as they are paid for providing the data to the insurance company, thus creating a sustainable mechanism for the RICE innovation to continue serving the farmers. TNAU has already received more than 20 million Indian Rupees (~267,000 USD) from the insurance companies. TNAU is part of State Level Coordination Committee on Crop Insurance (SLCCI), wherein in 2018 it |

was mentioned that IRRI Satellite based rice monitoring system to be used to support the 'Pradhan Mantri Fasal Bima Yojana' (PMFBY) crop insurance program for rice (CRP 2018 Annual report). SLCCI is a legal entity in India responsible for elaborating and implementing crop insurance schemes in that state. As per RICE reports, this has allowed for continued contribution of satellite-based rice monitoring technology in the PMFBY crop insurance program. Five government departments in the state are regularly using data provided by TNAU (RICE partner).

In the Philippines, RICE helped PhilRice to set up the Philippines Rice Information System (PRISM). The RICE technology of remote sensing is well-institutionalized (handed over) within the Department of Agriculture (DA) as PRISM provide DA accurate, location-specific information related to area, production, yield, and assessment of damages in the events of floods and drought. It is evident from several project documents that PRISM outputs are being used by policymakers to design interventions where needed. A regular rice monitoring using remote sensing and crop models is being done to estimate and forecast yields. PRISM has evidently strengthened the capacity of DA. Build, Operate, and Transfer (BOT) and technically assistance model is successfully implemented in Philippines. RICE team shared two Administrative Orders signed by the then Secretary of the Department of Agriculture creating the PRISM unit at PhlRice and the creation of a technical working group for ICT Support. PRISM was designed to become an operational system, which has been achieved. Funding for the PRISM unit and activities in the regions are integrated in the operational budget of the respective organizations. However, no insurance component is attached in Philippines.

Thailand: Interest of government and private partners in Thailand on using the RIICE technology within their existing national crop insurance scheme was low. No agreement was reached with the Fiscal Policy Office (RIICE partner in Thailand) to pilot RIICE within their national crop insurance scheme despite strategic exchanges and sharing of concept notes.

Indonesia: In 2019, there was renewed interest from Bappenas (Ministry of National Development and Planning) to explore the use RIICE for rice monitoring and crop insurance. IRRI and sarmap were invited to give a presentation. However, Bappenas found the cost to set up a national rice monitoring scheme using the RIICE technology too high, so the discussion did not progress.

In Vietnam and Cambodia, the initiative is in the initial stages, where partner capacity development is taking place. As per the RIICE team, the project produces rice crop monitoring datasets including maps and statistics on e.g., rice areas, start of season, yield. These datasets are directly used by government for their planning, and do not have a direct impact on populations of farmers. It can be noted however, that both in Cambodia and Vietnam, there are ongoing insurance pilot applications. These pilots concern four provinces in Cambodia and seven in Vietnam. In Cambodia, the dry run concerns 9 districts, 20 village communes, and 211 villages for more than 5458 farmers and more than 56500 ha. No information on the number of farmers involved in the insurance application pilot in Vietnam is currently available.

In Indonesia and Thailand, as stated above, the initiative could not succeed as RICE could not provide a robust and convincing demonstration of the use of technology to the government partners.

**Analysis**

*Mapping of the outcome to the CRP/Flagship ToC. How does it fit into the narrative of the ToC. Analysis of the reported outcome/impact, using the evaluation criteria of quality of science and effectiveness (also using findings from document review and/or interviews with key informants). Cross-referencing to the QoR4D Framework criteria of scientific legitimacy and credibility.*

The OICR is fully in accord with the narrative of the CRP as it contributes to the stated outcome of increased profitability for men and women farmers. It achieves institutionalization of the RICE technology within the government set-up in India and Philippines. It proves the stated assumption of the ToC that successful scale up will depend on policy actions needed. RICE partners have managed to secure those policy actions in specific sites for achieving wide-scale application at those sites.

The OICR is fully in accord with the narrative of the flagship 1 ToC as well as this RICE innovation contribute to the stated outcome of 'better delivery partnerships with capacity to innovate'. One of the main architects of the technology Dr. Sellaperumal Pazhanivelan from Tamil Nadu Agriculture University said that, "we believe that this technology can help the state governments to obtain

objective and transparent data on actual rice yields so that farmers affected by natural hazards can be identified quickly"[7].

The RICE CRP through the IRRI team has played stellar role in capacity development of partners on yield estimation model. This has been well acknowledged by partners that the reviewers spoke to. RICE played a catalyst role for TNAU to integrate remote sensing to crop growth estimation model for spatial estimation of yield. Without RICE CRP support, this would not have been possible. The partners also learnt project management capabilities from RICE team. Overall, a very high degree of satisfaction is expressed by the partners in this collaborative work with RICE.

The case is presented at level 2 (as per updated OICR in 2019), but the progress achieved in some countries (such as Philippines and India) indicate the contribution of RICE has advanced to level 3. A level 3 achievement is attainable in other countries (Cambodia, Vietnam, sub-national in India) as well, if suitable enabling actions are implemented. In Cambodia and Vietnam, the evidence presented indicate a level 2 achievement, while in Orissa and Andhra Pradesh in India, evidence indicate an achievement at level 1.

The OICR scalability is high if identified enabling actions are undertaken. In Orissa and Andhra Pradesh in India, RICE would need to find partners of standing such as TNAU and supportive bureaucrats (champions) who are convinced about the potential of the technology. TNAU experiences would need to be utilized for capacity development, learning and demonstrations. The key success factor observed in Tamil Nadu was enactment of edicts/rules by the state government to the insurance companies so that they necessarily use satellite monitoring data produced by TNAU. Though Govt of India has stipulated guidelines to this effect, however, agriculture is a state subject and therefore a State Govt order would help in promotion and wide scaling of this initiative.

Other countries such as Bangladesh has lot of potential in crop monitoring, wherein contextual validation of the tools used in India would need to be carried out. The expert in TNAU says that crop monitoring is different from natural resources or water monitoring using satellite. In water resource monitoring, one tool developed can be far easily replicated to other locations than is the case with crop monitoring. Herein RICE experiences in multiple countries can aid in faster replication. RICE/IRRI is working on replication proposals for African and other countries.

Technology would need continuous advancement as well. Government is likely to focus on village/commune level data for all crops and so the technology advancement should allow movement towards crop inventory system and integrate deep learning modules, and Artificial Intelligence (AI) for advanced analytics. TNAU has already started to build deep-learning modules that can process data in one hour (currently it takes 24 hours) and expand the geographical and crop coverage. Continuous advancement would be critical to stay in the game as big-pocket players such Microsoft and Google are venturing into this field. However, credibility of research and academic institutions would be difficult to challenge as generally Governments and insurance companies would prefer to work with research institutions who would not have any conflict of interest in data provisions.

Satellite monitoring uses Swiss software called 'Sarmap', a commercial software, for analyzing satellite data. Even though it is producing impact, still it is being considered costly by TNAU administration and finance team. TNAU is making an annual payment of 3 million (~40,000 USD) Indian Rupees for rights to use the software. TNAU is looking for alternatives as comparatively other available software cost one third of the price of Sarmap. The RICE team can potentially explore a collective license for use of this software in multiple countries to provide partners a cost-effective access to what is a highly useful software.

IRRI with partners in India and the Philippines have successfully implemented a satellite-based rice monitoring system. As per one of the stakeholders interviewed, CIMMYT, ICRISAT, IWMI and several other CG institutions are involved in specific crop monitoring systems using spatial technologies (Satellite, drone, mobile). The expertise in this area are very demanding and costly, including personnel, infrastructure, and software costs. While it was beyond the purview of this review to find out to what extent sharing of resources on path-breaking initiatives (such as satellite-based crop

[7] Source: http://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-1/Sentinel-1_speeds_up_crop_insurance_payouts

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| monitoring) are happening across the CRPs /Centers, the insights gathered through this review indicate there could be scope for improved collaboration on this front. Crop growth models across the institutions can be integrated. IRRI's microwave remote sensing and IFPRI's mobile based application can be integrated. The Community of Practice on Crop Modeling (CoPCM) of the CGIAR Platform for Big Data in Agriculture can facilitate these integrations, if not the case already. TNAU is moving ahead with plans to utilize its rice experience of satellite monitoring to other crops. It is talking to ICRISAT on groundnut and pulses, and IWMI on drought and floods. This collaboration is not yet established. |
| **Conclusions**<br>*Example questions: To what extent does the OICR represent the application of the CRPs research to developmental outcomes? What further information would be useful to elaborate that logic, with reference to the CRP theory of change? What implicit assumptions are revealed by the OICR analysis? What lessons emerge for the CRP or the CGIAR more generally, based on this outcome?*<br><br>This OICR present one of remarkable success and contribution of the RICE CRP. This is more so as remote sensing-based rice monitoring system in several countries is leading to improved climate resilience and adaptation. This RICE innovation can easily be considered as one of most significant as it has been taken to scale in India and the Philippines while it is developing well in Cambodia and Vietnam.<br><br>Having gained the experience, RICE is actively exploring replication within India (in different states such as Bihar, Orissa and Andhra Pradesh) and also in other countries (such as Bangladesh), which more likely than not will happen in the near future. This RICE innovation also has the potential to be adapted to other agri-food systems such as groundnut, pulses. RICE should continue to prioritize its work on this front and support further wide-scaling and impact.<br><br>As noted in the case study, RICE partners in India are experiencing obstacles in funding the cost of use of Sarmap. Even though Sarmap is private proprietary software, there still might be opportunities for the CRP team to negotiate the cost of its use across sites to potentially lower the cost directly funded by the partners in different countries. Alternatively, RICE can facilitate use of other softwares that are more cost effective for the partners.<br><br>With such high significance attached to this initiative, it is important for RICE to annually publish an open access paper with updated status of achievements and challenges across the countries where it is being replicated. |

## *Review of OICR number 3198: Improved rice variety (WITA 9) was adopted by 24% of rice farmers and increase income by US$ 91 per ha in Cote d'Ivoire*

Why this OICR was selected?

This OICR was selected as impact of this is already being realized across sub Saharan Africa. The case is presented at level 3. Another important reason for selecting this was that further superior germplasm are being developed from within these base materials (NERCIA) which are in the pipeline and will offer farmers even higher advantages in terms of yield and quality of their harvest.

Overview of case:

The adoption of improved rice varieties bred by Africa Rice & IRRI by farmers in 16 countries in sub-Saharan Africa, was estimated at 3.5 million ha, including 1.4 million ha for NERCIA varieties. Yield increased with 320 kg per ha with adoption of NERCIA varieties. More than 8 million people were lifted out of poverty and 7.2 million people out of food insecurity. Average income also increased from US$ 25 per capita to US$ 58 per capita for NERCIA adopters.

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| **OCR number and title:** CRP, OICR Number 3198: Improved rice variety (WITA 9) was adopted by 24% of rice farmers and increase income by US$ 91 per ha in Cote d'Ivoire |
| CRP Led (there are cases where the CRP lead is different because one OICR may be reported under more than one CRP) - RICE |

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| Phases of report (new/updated same level/updated new level of maturity): Stage 3 | | |
| If for Innovations at Level 4 or Policies at Levels 2 and 3 | | |
| Year reported: 2017 | Maturity level: Stage 3 | # Years of programmatic work: 2017 |
| Geographic location(s): Benin, Burkina Faso, Cameroon, Cote d'voire, Gambia, Ghana, Madagascar, Mali, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo | | |
| Populations covered, estimated size and socio-demographic categories (e.g., subsistence farmers, women, adolescents, etc.) 7.2 million people | | |
| **Key contributors to the outcome** | | |
| CGIAR (other CRPs, Platforms, FPs, centers): Flagship 1, 2, 3 and Flagship 5 | | |
| **External partners** (partners outside of CGIAR/the CRP framework): Large number of national partners in the 16 countries (Benin, Burkina Faso, Cameroon, Cote d'voire, Gambia, Ghana, Madagascar, Mali, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo) | | |
| **Links to the CGIAR Strategic Results Framework:** (IDOs and sub-IDOs)<br>Sub-IDOs: Enhanced genetic gain; DRF targets: 100 million more farm households have adopted improved varieties; 30 million people assisted to exit poverty.<br>Adoption of CGIAR materials with enhanced genetic gains; Increased livelihood opportunities | | |
| **[CRP] contributions to the outcome (list any of the following)** | | |
| Innovations – Development and dissemination of improve varieties which contributed to enhanced food security and reduced poverty | | |
| Policies - | | |
| Key CRP publications supporting the OICR – Arouna A. et al. 2017. Contribution of improved rice varieties to poverty reduction and food security in sub-Saharan Africa. Global Food Security, 14: 54-60 | | |
| **OICR relationship with CGIAR cross-cutting issues (YES/NO)** | | |
| Capacity development- yes | | |
| Climate change - yes | | |
| Gender - yes | | |
| Youth - yes | | |
| Key implementing organization (e.g. institute, partner): Africa Rice and 16 NARS partners across sub Saharan Africa | | |
| External partners related | | |
| **Partnerships:** Key partners ([CRP]'s engagement with each partner, and extent to which partner expectations/needs were met or not) | | |
| **Brief reviewer's description of the outcome (based on OICR report, documents cited, original data collected/interviews and other references)**<br>By 2014, the adoption of improved rice varieties by farmers in the studied countries (Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Gambia, Ghana, Madagascar, Mali, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Tog) was estimated at 1.4 million ha of NERCIA varieties. About 1 million households totaling 8 million individuals, and 0.9 million households totaling 7.2 million individuals in sub Saharan Africa have been lifted out of poverty and food insecurity, respectively, in 2014. | | |
| **Analysis**<br>*Mapping of the outcome to the CRP/Flagship ToC. How does it fit into the narrative of the ToC. Analysis of the reported outcome/impact, using the evaluation criteria of quality of science and effectiveness (also using findings from document review and/or interviews with key informants). Cross-referencing to the QoR4D Framework criteria of scientific legitimacy and credibility.*<br><br>Impact of the OICR is fully analyzed and documented (for details please see Arouna A. et al. 2017. Contribution of improved rice varieties to poverty reduction and food security in sub-Saharan Africa. Global Food Security, 14: 54-60). Data collected from 16 sub Saharan countries has revealed that the adoption of improved rice varieties based on NERCIA germplasm is having a positive impact on different outcomes including production, income, expenditure, poverty reduction, and food security. Adoption is continuing and impact of such varieties on people's income and livelihood is constantly increasing. | | |
| **Conclusions**<br>*Example questions: To what extent does the OICR represent the application of the CRPs research to developmental outcomes? What further information would be useful to elaborate that logic, with reference to the CRP theory of change? What implicit assumptions are revealed by the OICR analysis? What lessons emerge for the CRP or the CGIAR more generally, based on this outcome?* | | |

Development of NERCIA germplasm, and of their dissemination and adoption in SSA countries, is a success story. The adoption of such varieties and of their impact on increased yield is well documented. As a result of adoption of such germplasm/varieties 7.2 million people from within SSA have been lifted out of food insecurity. Average income of NERCIA adopters also increased from US$ 25 to US$ 58. Interestingly, breeders at Africa Rice are further improving NERCIA germplasm and many novel varieties are in the pipelines with much higher yield potential. Availability of these will further enhance food security in the region and also their livelihood and income potentials.

# Annex 16: Conflict of Interest Statements by the Review Team

CGIAR Advisory Services

**Annex 1 - Conflict of Interest Statement**

1. Main employer and any other organization that provides you with remuneration (which may be named participants in the project/program/proposal you are being asked to review/evaluate)

   Please provide details: **My sole employer is Aberystwyth University**

2. Are you aware whether a relative, close friend, close colleague or someone with whom you have financial ties is receiving funding from or giving advice to a project/program/proposal you are being asked to review/evaluate?

   ~~Yes/~~No

   If Yes, please provide brief details: **N/A**

3. Does any project/program/proposal you are being asked to review/evaluate cite any of your own current research?

   ~~Yes/~~No

   If Yes, please provide brief details: **N/A**

4. Does any project/program/proposal you are being asked to review/evaluate name researchers with whom you have active collaborations, recently published joint papers or are in regular email correspondence?

   ~~Yes/~~No

   If Yes, please provide brief details: **N/A**

5. Does any project/program/proposal you are being asked to review/evaluate name any of your past PhD students are active participants?

   ~~Yes/~~No

   If Yes, please provide brief details: **N/A**

**Declaration:** I declare that the information provided on this statement is true and complete.

**Name: Dr Rattan Yadav**

**Signed:**

**Date: 1 September 2020**

CGIAR Advisory Services

## Annex 1 - Conflict of Interest Statement

1. Main employer and any other organization that provides you with remuneration (which may be named participants in the project/program/proposal you are being asked to review/evaluate)

   Please provide details: **My employer is Natural Resources Institute, University of Greenwich, UK. We are not named participant in the RICE CRP.**

2. Are you aware whether a relative, close friend, close colleague or someone with whom you have financial ties is receiving funding from or giving advice to a project/program/proposal you are being asked to review/evaluate?

   Yes/**No**

   If Yes, please provide brief details:

3. Does any project/program/proposal you are being asked to review/evaluate cite any of your own current research?

   Yes/**No**

   If Yes, please provide brief details:

4. Does any project/program/proposal you are being asked to review/evaluate name researchers with whom you have active collaborations, recently published joint papers or are in regular email correspondence?

   Yes/**No**

   If Yes, please provide brief details:

5. Does any project/program/proposal you are being asked to review/evaluate name any of your past PhD students are active participants?

   Yes/**No**

   If Yes, please provide brief details:

**Declaration:** I declare that the information provided on this statement is true and complete.

**Name: Ravinder Kumar**

**Signed:**

**Date: October 7, 2020**

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