Global Rice Science Partnership

Partnership in motion

CGIAR Research Program on Rice
Global Rice Science Partnership

The Global Rice Science Partnership (GRiSP), a research program of the CGIAR, represents for the first time ever a single strategic and work plan for global rice research. GRiSP brings together hundreds of scientists to embark on the most comprehensive attempt ever to harness the power of science to solve the pressing development challenges of the 21st century. Cutting-edge science is deployed to develop new rice varieties with high yield potential and tolerance of a variety of stresses such as flooding, salinity, drought, soil problems, pests, weeds, and diseases. Improved natural resource management practices will allow farmers to fully realize the benefits of such new varieties on a sustainable basis while protecting the environment. Future rice production systems are designed to adapt to climate change and to mitigate the impacts of global warming. Policies conducive to the adoption of new varieties and cropping systems will be designed to facilitate the realization of development outcomes. GRiSP will train future rice scientists and strengthen the capacity of advisory systems to reach millions of farmers. For impact at scale, GRiSP scientists collaborate with hundreds of development partners from the public and private sector across the globe.

GRiSP was launched in 2010 and is coordinated by three members of the CGIAR Consortium—the International Rice Research Institute (IRRI, the lead institute), Africa Rice Center (AfricaRice), the International Center for Tropical Agriculture (CIAT)—and three other leading agricultural agencies with an international mandate and with a large portfolio on rice: Centre de Cooperation lnternationale en Recherche Agronomique pour le Développement (Cirad), L'Institut de Recherche pour le Développement (IRD), and the Japan International Research Center for Agricultural Sciences (JIRCAS). Together, they align and bring to the table consortia, networks, platforms, programs, and collaborative projects with over 900 partners from the government, nongovernment, public, private, and civil society sectors.

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GRiSP: Partnership in motion

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Preface

The CGIAR Research Program for Rice, known as the Global Rice Science Partnership (GRiSP), is a partnership coordinated by six research-for-development organizations that bring together over 900 partners from the academic, public, private, and civil society sectors with a stake in the rice development sector. It is noteworthy that the "P" in the GRiSP acronym stands for "partnership" and not for "program." Embedded within GRiSP are many "subpartnerships," such as consortia, networks, platforms, and time-bound projects. Some partnerships are decades old and now aligned with GRiSP's mission and objectives, while other partnerships have just recently been established to serve a specific purpose along GRiSP's impact pathway toward development. All partners are, in one way or another, bound together by a common mission of poverty alleviation, rice food security, and environmental sustainability and protection. Some partners work on a global scale, while others work in particular watersheds, villages, or small communities. Some partners work at the grass-roots level, trying to improve the livelihoods of smallholder rice farmers through hands-on participatory action, while others work with rice genes in advanced laboratories in countries where no rice is even produced or very little is eaten.

How does one bring together over 900 partners from such a wide background in a globally coordinated approach to rice research for development? What are the partnership mechanisms and structures that operate under GRiSP? How do the GRiSP coordinating partners align GRiSP's strategy and activities with those of rice-growing nations and with regional multinational development bodies? This document attempts to give some answers to these questions and to shed light on the functioning of the many partnership arrangements under GRiSP. It serves as a stock-taking exercise from which lessons can be drawn to improve GRiSP as a global partnership mechanism in the years to come. This document also serves as an input to the GCARD Road Map,[1] and the GRiSP partnerships described herein follow up on the commitments made at the Second Global Conference on Agricultural Research for Development (GCARD2), Punta del Este, Uruguay, in 2012.

Bas Bouman
Director, GRiSP

[1]The GCARD Road Map, Transforming agricultural research for development systems for global impact, 2011. GFAR Secretariat, FAO, Rome, Italy.

1 GRiSP synopsis: objectives, themes, and products

The CGIAR Research Program for Rice, known as the Global Rice Science Partnership (GRiSP), provides a single strategic plan and unique new partnership platform for impact-oriented rice research for development (www.cgiar.org/ rice-grisp/). It streamlines the rice research for development activities of CGIAR and aligns them with more than 900 rice research and development partners worldwide to

- Increase rice productivity and value for the poor.
- Foster more sustainable rice-based production.
- Help rice farmers adapt to climate change.
- Improve the efficiency and equity of the rice sector.

GRiSP's mission, in accordance with that of CGIAR, is to reduce poverty and hunger, improve human health and nutrition, reduce the environmental footprint, and enhance the ecosystem resilience of rice production systems through high-quality international rice research, partnership, and leadership. It aims to achieve this mission through fostering high-quality, impact-oriented research and development activities in a global context. The key entry point for achieving this mission is the substantial increase in the productivity and resource efficiency of rice production systems. This will enable farmers to enter a virtuous circle, allowing them to also invest more in diversification and sustainable management practices.

GRiSP activities are organized in six research and development themes (Table 1.1). Under each theme, so-called "product lines" are defined as families of products or deliverables that provide global or regional options for next, intermediate, and final users along the impact pathway. Examples of GRiSP products are newly discovered genes and QTLs, prebreeding lines, varieties, natural resource management technologies, information systems and databases, decision support systems, and policy advice. Product-oriented interdisciplinary activities are carried out with partners to develop innovative products and facilitate their uptake. Products can be global or regional in their targeted usage, and are based on evidence for large impact potential.

2 Key GRiSP partnership principles

The Global Rice Science Partnership strategizes and aligns the rice research for development (R&D) agenda of six major R&D organizations with an international mandate and with a large portfolio on rice: three members of the CGIAR Consortium—the International Rice Research Institute (IRRI, the lead institute), Africa Rice Center (AfricaRice), the International Center for Tropical Agriculture (CIAT)—and three other leading international agricultural agencies: Centre de Cooperation Internationale en Recherche Agronomique pour le Développement (Cirad), L'Institut de Recherche pour le Développement (IRD), and the Japan International Research Center for Agricultural Sciences (JIRCAS). These six institutions are the founding and coordination partners of GRiSP. Together, they align and bring to the table consortia, networks, platforms, programs, and collaborative projects with over 900 partners from the governmental, nongovernmental, public, private, and civil society sectors (Fig. 2.1). On a global scale, GRiSP acts as an overarching umbrella and "organizing principle" for rice research for development. All partners, in some way, contribute to GRiSP's goals, objectives, product developments, and impact pathway, be it at a local, national, international, or global level. GRiSP facilitates interaction among partners across the globe not only through its combined research agenda and R&D activities but also

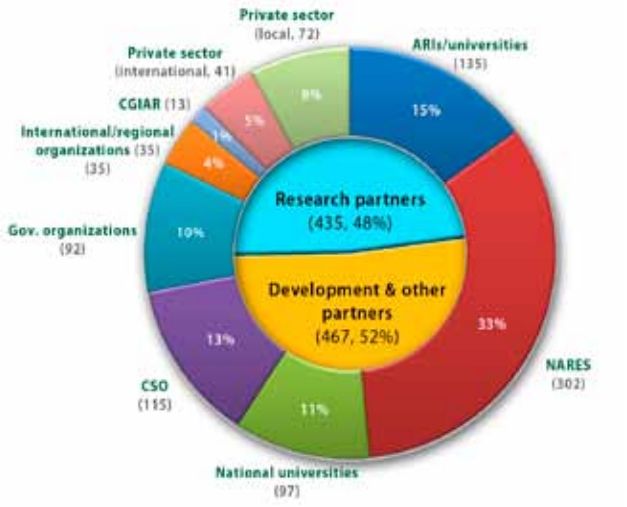


Fig. 2.1. Number and type of GRiSP partners as of September 2010; the inner circle provides a breakdown by partner roles (research vs. boundary partners). The outer circle provides a classification by organizational categories. About 48% of the GRiSP partners mainly play a role as research partners, whereas 47% are mainly development partners and 5% are other boundary partners.

Table 1.1. GRiSP themes and product lines (PL).

Theme 1: Harnessing genetic diversity to chart new productivity, quality, and health horizons
PL 1.1. *Ex situ* conservation and dissemination of rice germplasm
PL 1.2. Characterizing genetic diversity and creating novel gene pools
PL 1.3. Genes and allelic diversity conferring stress tolerance and enhanced nutrition
PL 1.4. C_4 rice
Theme 2: Accelerating the development, delivery, and adoption of improved rice varieties
PL 2.1. Breeding informatics, high-throughput marker applications, and multienvironment testing
PL 2.2. Improved donors and genes/QTLs conferring valuable traits
PL 2.3. Rice varieties tolerant of abiotic stresses
PL 2.4. Improved rice varieties for intensive production systems
PL 2.5. Hybrid rice for the public and private sectors
PL 2.6. Healthier rice varieties
Theme 3: Ecological and sustainable management of rice-based production systems
PL 3.1. Future management systems for efficient rice monoculture
PL 3.2. Resource-conserving technologies for diversified farming systems
PL 3.3. Management innovations for poor farmers in rainfed and stress-prone areas
PL 3.4. Increasing resilience to climate change and reducing global warming potential
Theme 4: Extracting more value from rice harvests through improved quality, processing, market systems, and new products
PL 4.1. Technologies and business models to improve rice postharvest practices, processing, and marketing
PL 4.2. Innovative uses of rice straw and rice husks
PL 4.3. High-quality rice and innovative rice-based food products
Theme 5: Technology evaluations, targeting, and policy options for enhanced Impact
PL 5.1. Socioeconomic and gender analyses for technology evaluation
PL 5.2. Spatial analysis for effective technology targeting
PL 5.3. A global rice information gateway
PL 5.4. Strategic foresight, priority setting, and impact assessment for rice research
Theme 6: Supporting the growth of the global rice sector
PL 6.1. Innovation in learning and communication tools and extension capacity development
PL 6.2. Effective systems for large-scale adoption of rice technologies in South Asia
PL 6.3. Effective systems for large-scale adoption of rice technologies in Southeast and East Asia
PL 6.4. Effective systems for large-scale adoption of rice technologies in Africa
PL 6.5. Effective systems for large-scale adoption of rice technologies in Latin America and the Caribbean

through workshops, conferences, study tours, and field visits (Fig. 2.2).

Neil Palmer, CIAT

Fig. 2.2. GRiSP organizes field visits and study tours across the continents to allow partners from different organizational backgrounds to interact and exchange ideas. Here, the deputy director general of the Department of Crop Production of the Ministry of Agriculture and Rural Development of Vietnam (right) meets a scientist from the Uruguayan National Agricultural Research Institute (INIA) during a GRiSP field visit in Uruguay, 2012.

Among the more than 900 partners involved in GRiSP, three major types of partners are distinguished, although their roles often dovetail and overlap.

- **Research partners** play an active role in research and product development in GRiSP Themes 1–5, and are thus co-accountable for such products. Research partners are influenced by development partners and GRiSP beneficiaries in focusing their research and product development to meet the needs of farmers and other stakeholders in the rice value chain (so that GRiSP's goals and objectives are met).
- **Development partners** may be involved in more adaptive research (local adapters) and/or play a significant role in the dissemination and adoption process (disseminators). Typically, development partners are influenced by GRiSP research partners to mobilize resources for scaling out GRiSP products, whereas they exert influence on the research partners in product development choices and direction (see above). Development partners do not necessarily receive much funding from GRiSP and need access to considerable extra resources (typically 10-fold the level of funding for product development) for reaching millions of farmers (and other beneficiaries) and having "impact at scale." The majority of partners in GRiSP Theme 6 are development partners, for which success in outscaling new information and technologies largely depends on the resources they mobilize.
- **Other partners** may not be directly involved in developing, adapting, or disseminating GRiSP products, but they are in need of information on GRiSP and its outputs for various purposes. They include, for example, policymakers, international or regional associations or organizations, media, development funds, regional development banks, donors, and political organizations.

Development and other partners may also be referred to as **boundary partners**, that is, partners that are not directly accountable for developing GRiSP products, but that play a major role in delivering development outcomes and impact at scale. GRiSP is the umbrella partnership that integrates research and development (boundary) partners into one common framework with jointly accepted goals and objectives.

Beneficiaries of GRiSP's R&D products and services are ultimately the stakeholders along the rice supply chain, from farmers, millers, processors, and traders all the way up to consumers. They can also include producers of inputs (such as machinery and postharvest tools and equipment) and of services (such as providers of farm operations such as land leveling, harvesting, etc.) and buyers and traders of outputs. Intermediate beneficiaries are actors that play a role in locally "enriching," adapting, and passing on information, products, and services to end users, such as advisory services and extension agents, and local knowledge partners. Examples of specific beneficiaries of products from Theme 6 are policymakers, development banks, donors, and political organizations. Beneficiaries are typically involved in the process of product development and dissemination of GRiSP and thus are often part of partnership arrangements.

GRiSP partnerships are based on the principle of equality, and GRiSP strives toward minimum financial interdependencies. In equal partnerships, partners find each other in common goals and objectives. They first bring their own activities to the table that are aligned with GRiSP's overall and commonly agreed-upon R&D agenda. These own activities are funded by a combination of what can be seen as "core" institutional or program funding and specific grant projects. For IRRI, AfricaRice, and CIAT, core funding derives primarily from the CGIAR Window funding mechanism. For these institutes, this CGIAR Window funding typically varies from about 25% to 45% of

their total GRiSP budget (this number varies over the years), whereas bilateral grants provide the remaining. For Cirad, IRD, and JIRCAS, core funding derives from national government funds. The more than 900 GRiSP partners all have their own specific core funding arrangements (depending on whether they are government, private sector, NGO, etc.), and generally receive additional funding through their involvement in bilateral grant projects with one or more of GRiSP's coordinating partners. GRiSP also sets aside a portion of the CGIAR Window funding to support GRiSP partners on specific cross-cutting activities such as workshops, partnership building, capacity building, and joint new-frontier research. In total, around 30% of the GRiSP budget coordinated by the three CGIAR centers flows through to non-CGIAR partners. Because of the sheer complexity of such a task, the monetary value of GRiSP activities contributed by the three non-CGIAR coordination centers (Cirad, IRD, and JIRCAS) and by the more than 900 other partners has not been made explicit.

3 The evolution of partnerships along GRiSP's impact pathway

GRiSP is implemented through a variety of partnership arrangements that evolve in size and composition across the impact pathway from product development to having impact at scale (Fig. 3.1). Typically, the partnership share of "pure" research partners decreases going from upstream research and basic product development (on the left of the impact pathway) to dissemination and delivery (on the right of the impact pathway), while the partnership share of development partners increases. It is important, however, that both types of partners, along with various types of beneficiaries, be included at all stages along the impact pathway (especially in the design phase of product development) to ensure relevance to stakeholders' needs.

The development and delivery of submergence-tolerant rice varieties is a good example of evolving partnerships along the impact pathway (Fig. 3.2).

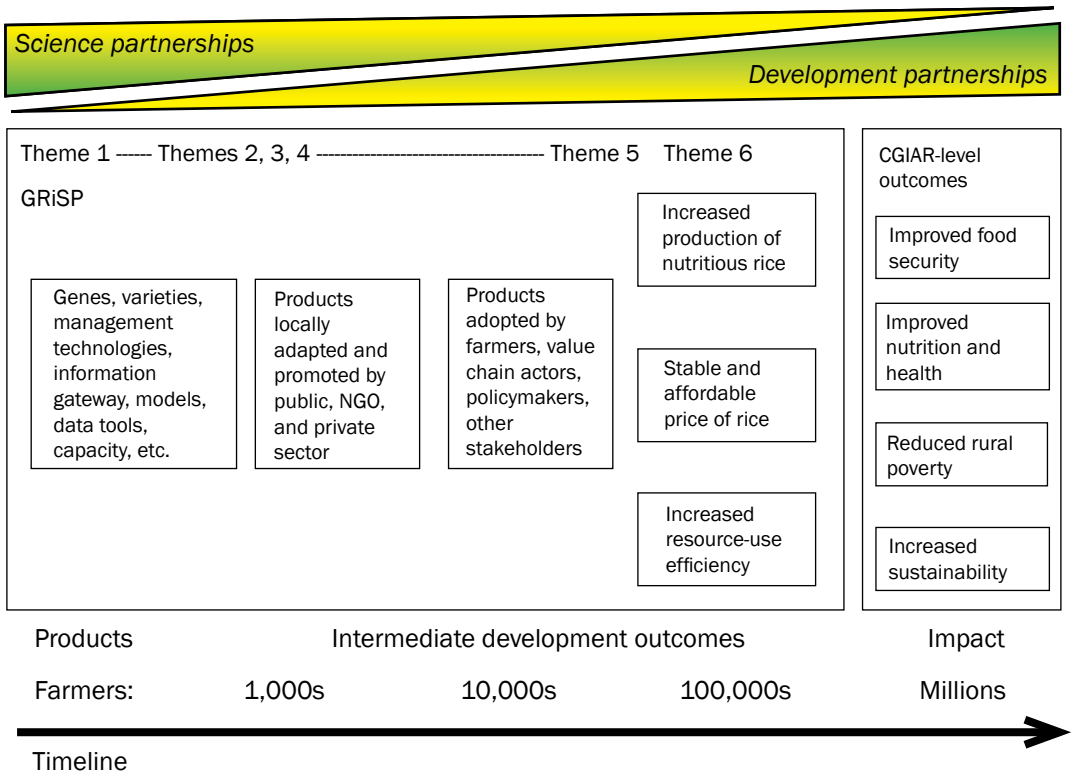
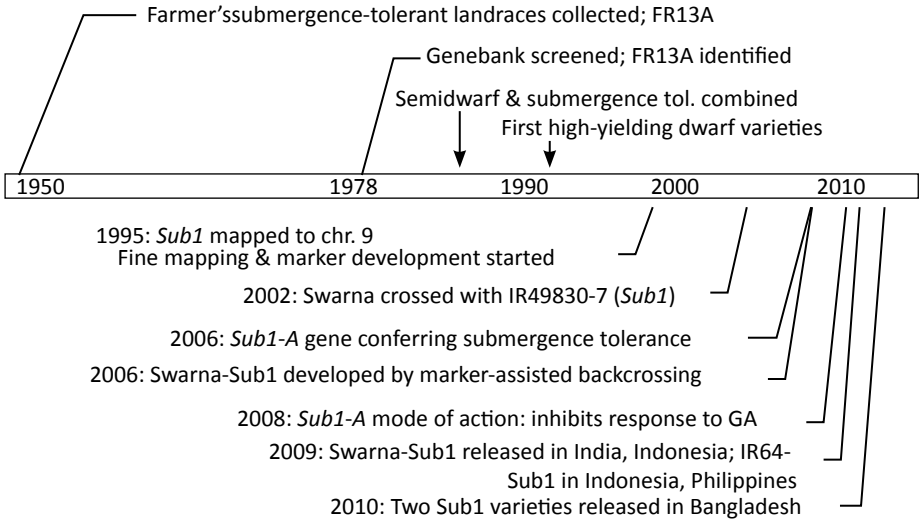


Fig. 3.1. Generalized impact pathway of GRiSP. Products of research (left-hand side) are tested, adapted, and promoted by GRiSP's research and development partners, and taken up by the ultimate beneficiaries such as farmers (but also other actors along the rice value chain) to produce intermediate development outcomes and ultimately impact at scale (right-hand side). Through the actions of the development partners, the number of farmers benefiting from GRiSP's products increases from several hundred early in the product development phase (e.g., those farmers participating in pilot projects) to millions after products have been locally adapted and made responsive to local farmers' preferences. The impact pathway is not a linear process, and the many underlying feedback loops and interactions are omitted for simplicity.



Year							
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Partners	NARES (2)	NARES (8)	NARES, NGOs, FO, seed co. (22)	NARES, FO, NGO, seed co., NFSM, state govs., industry (54)	100 public- and private-sector partners	> 130 public- and private-sector partners	
Activities	Seed multiplication	Evaluation	Evaluation, demonstration	Release (June), seed multiplication	Dissemination, adoption, impact assessment		
Seed amount	2 kg	100 kg	3 -> 15 t	> 1,000 t	10,000 t	40,000 t	
No. of farmers			700	5,000	> 100,000	4 million	

Fig. 3.2. Timeline of major scientific achievements with upstream research partners in the discovery of the submergence-tolerance gene *SUB1* and in the development of submergence-tolerant rice (top); timeline, activities, seed multiplication, and number of farmers adopting submergence-tolerant varieties in India during the outscaling phase (bottom) (see text for explanation). FO = farmer organization; NFSM = National Food Security Mission, India.

This example also illustrates GRiSP's accountability to its main beneficiaries, the rice farmers. For decades, farmers in marginal and resource-poor areas have been left behind in the process of rural development because the high-yielding varieties of the Green Revolution were not fit for their harsh environments. For example, salinity, uncontrolled submergence, or droughts severely reduced the yield potential of the new Green Revolution varieties. Despite the development of response options such as improved water management and short-duration varieties that could escape droughts or floods, farmers kept asking for stress-tolerant varieties with high yield potential. In response, despite the supposed "intractability" of such traits, scientists kept searching for stress tolerance in the genetic makeup of rice. Partnerships in these early decades included chiefly CG centers and advanced research institutes in developed countries that worked on the frontier of developments in molecular biology and biotechnology. Eventually, these science partnerships were able to identify QTLs, and later specific genes, that confer submergence tolerance, and developed markers and the tools of marker-assisted selection to breed these genes into popular mega-varieties grown in the target domain. At that stage, the partnership composition shifted to include more national breeding institutions in the target environments (in this case, eastern India and Bangla-

desh) to develop and test local varieties. Farmers were involved through participatory varietal selection (PVS) in their own fields. With the development of locally adapted, submergence-tolerant varieties (so-called "scuba" or "underwater" rice), the partnership started to include more national seed distribution systems, private seed companies, NGOs, farmer organizations, and community seed bank systems. These types of partners are crucial in delivering the seeds of these new varieties to the millions of farmers who need them, and, where such partners did not exist, GRiSP embarked on facilitating their creation, for example, through business model development. The main partnership mechanisms for delivery at scale were/are the Consortium for Unfavorable Rice Environments (section 5.1.2), the STRASA project (section 5.3.1), and the CSISA project (section 5.3.2).

In conclusion, whereas the basic background research started with predominantly science partnerships sometime in the mid-1970s, now some 3.5 million farmers In eastern India and Bangladesh benefit from newly developed submergence-tolerant rice varieties through predominantly development partnerships (Fig. 3.3). Under GRiSP, partnership arrangements were recently extended into Africa to include (or set up) local breeding and seed distribution partners to develop and disseminate African submergence-tolerant varieties. Breeders and scientists are now also developing the next generation of stress-tolerant varieties in which genes that confer tolerance to different stresses are combined into the same variety. An example of this so-called "two-in-one" is the pyramiding of genes for tolerance of submergence and of salinity to develop varieties suitable for areas that get inundated with saline water (e.g., in coastal zones).

4 Key partner types

4.1 GRiSP founding and coordinating partners

GRiSP is managed and coordinated by its founding partners, IRRI, AfricaRice, CIAT, Cirad, IRD, and JIRCAS, through their equal participation in GRiSP's Program Planning and Management Team (each partner has one representative at the level of deputy director general for research or at the level of director or research program leadership). Sections 4.4.1 and 4.4.2 provide a description of the specific partnership role of Cirad, IRD, and JIRCAS. Other partners contribute to planning and implementation processes through various mechanisms, such as participation on GRiSP's oversight committee and on the many steering and

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Fig. 3.3. Submergence-tolerant variety Swarna-Sub1 (left) growing in a farmer's field in Uttar Pradesh, India, alongside a local variety (right) after 12 days of inundation.

advisory committees of the various projects, consortia, and networks that are embedded within GRiSP (see section 5).

4.2 National agricultural research and extension systems

The national agricultural research and extension systems (NARES) have been the key partners of IRRI, AfricaRice, and CIAT for decades, primarily through collaborative projects, networks and consortia, and science and extension capacity building. NARES partners range from those that emerge from national conflicts (such as Liberia) and thus require major assistance to those with strong national rice R&D capabilities in Africa (e.g., Egypt), Asia (e.g., China, India), and Latin America (e.g., Brazil). NARES are key partners in GRiSP as its activities are conducted to a large extent through their active involvement in research priority setting and implementation of R&D activities on the ground. Most partnerships with NARES and other sectors are implemented through GRiSP-embedded regional networks, projects, and consortia, which, through their steering committees composed of a wide range of partners, also play an important role in setting priorities, overseeing GRiSP research, and linking it with national systems and investments.

4.3 Strong national research systems

The national research systems in the so-called BRIC countries (Brazil, Russia, India, and China) are vast and have made rapid advances in recent years. In Africa, Egypt has excellent rice R&D capacity that has resulted in the highest average rice yield in the world, and this experience needs to be tapped in irrigated rice-based systems in sub-Saharan Africa. Hence, these countries play an increasingly strategic role in GRiSP.

4.3.1 Brazil

Key partners for GRiSP in Brazil are the Empresa Brasileira de Pesquisa Agropecuária (Embrapa—the Brazilian Agricultural Research Corporation) and the Instituto Rio Grandense do Arroz (IRGA), and various selected universities. Collaboration with Embrapa focuses on functional genomics (Theme 1); breeding of stress-tolerant varieties (Theme 2; Fig. 4.1); improving upland systems, including aerobic rice grown in rotation with other crops (Theme 3); value chain solutions (Theme 4); and information platforms (Theme 5). GRiSP strives to extend the cooperation with Embrapa in the Africa-Brazil Agricultural Innovations Marketplace. IRGA specializes in intensive, mechanized irrigated rice production under temperate conditions. Collaboration with IRGA focuses on germplasm and staff exchange, varietal development (including hybrid rice), management concepts and solutions for ecological intensification (Theme 3), and outscaling of agronomic best management practices, including extension strategies and learning alliances (Theme 6).

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Fig. 4.1. An Embrapa rice breeder in Uruguayana, Brazil, demonstrates new rice breeding lines. GRiSP facilitates the exchange of germplasm across continents.

4.3.2 Russia

Rice area in Russia is relatively small. Partnerships with GRiSP concentrate on germplasm improvement for temperate rice systems and training of young Russian scientists at IRRI. Russia, through the All-Russian Rice Research Institute, also plays a leading role in the Temperate Rice Research Consortium (section 5.1.3), and is a new donor to this consortium.

4.3.3 India

India is one of the most important partner countries for GRiSP. At present, some 170 partnerships exist between IRRI and Indian institutions and organizations. These include over 40 research institutions belonging to the ICAR (Indian Council for Agricultural Research) system (e.g., DRR, CRRI, CSSRI, IARI), universities, and others. On the other hand, some 130 active partnerships on adapting and disseminating new technologies and information involve other government entities such as the National Food Security Mission, the National Seed Corporation, many state agricultural and other universities, the departments of agriculture of 11 Indian states, about 25 district-level extension centers (Krishi Vigyan Kendras; KVK), 25

grass-roots-level NGOs and farmers' associations, and nearly 40 small and large private companies involved in seeds, machinery, and other inputs. Many of these are local development partners participating in recent regional initiatives such as STRASA (section 5.3.1) and CSISA (section 5.3.2), with emphasis on new delivery systems. GRiSP thus plays a significant catalytic role for enabling new multisector partnerships in India, supporting other and usually much larger government investments in the development of the rice sector. ICAR will act as a nodal point for GRiSP research activities in India and has identified GRiSP product lines (PLs) 1.2, 1.3, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 3.3, 3.4, and 5.1 as areas of major interest for research collaboration. Through IRRI, GRiSP will hold regular review and planning meetings with ICAR and other key research partners in India to prioritize research, ensure active participation of Indian scientists in specific GRiSP products, and improve funding and support mechanisms for collaboration (section 7.1). Moreover, ICAR is also interested in participating internationally, for example, through staff exchange and seconding scientists and other professional staff to Africa and other regions, for which GRiSP may provide an appropriate new umbrella. Science capacity, including sandwich scholarships, internships, and short courses, is also a major component of GRiSP–India collaboration.

4.3.4 China

China has the world's largest rice research capacity and is increasingly engaged in rice systems development work outside China. Nearly 40 Chinese research institutions, universities, and other entities collaborate with GRISP, particularly in areas such as gene discovery for molecular rice breeding (PL 1.2 and 1.3); C_4 rice (PL 1.4); the development of stress-tolerant varieties and hybrids with high yield potential (PL 2.4 and 2.5); water, nutrient, and pest management concepts and technologies for ecological intensification and diversification (PL 3.1 and 3.2); ecological engineering for biological control of pests (PL 3.1); and climate change (PL 3.4). China will also contribute significant new infrastructure to global genotyping and phenotyping efforts, notably through the Chinese Academy of Agricultural Sciences (CAAS), the Beijing Genomics Institute (BGI), and the recently (2012) established CAAS-Shenzen Institute of Breeding and Innovation (CSIRI). The Chinese molecular rice breeding network will lead the development of new Green Super Rice varieties and make those available to partners in Asia and Africa (PL 1.3, 2.1–2.5; section 5.3.3). China also plays a significant role in capacity building, including sandwich scholarships for Chinese and foreign students (between Chinese universities/institutions and IRRI, AfricaRice, and CIAT). One such program, supported by the Chinese Scholarship Council, already exists with IRRI. Moreover, the National Natural Science Foundation of China will issue annual competitive calls for research proposals focusing on selected GRiSP products. Each year, two new 3-year grants will be awarded to joint research teams of Chinese and IRRI or other GRiSP scientists.

4.3.5 Egypt

Egypt is expected to play a lead role in hybrid rice development in Africa (PL 2.5) and in capacity building at the Rice Technology Training Center for rice scientists and extension staff (PL 6.1 and 6.4). Egypt will also be involved in developing new irrigated rice-based systems responding to water scarcity and climate change (PL 3.1 and 3.4).

4.4 Advanced research institutes in developed countries

Partners from this sector are mainly involved as direct research partners in GRiSP, particularly in themes 1–5. GRiSP currently has collaborative research activities with over 130 such institutions in Europe, North America, Asia, and Australia. Their main role lies in conducting basic research that is beyond the capacities and comparative advantages of other GRiSP partners (see, for example, the C_4 Rice Consortium, section 5.2.4). Mobilizing these institutions within GRiSP is of great importance to deliver on anticipated science-based innovations. Most of the partnerships with these institutes are through bilateral grant projects and are specific to certain GRiSP products, but some are also involved in upstream research networks that include advanced research institutes from both developed and developing countries. As examples, below, we describe the strategic roles of Japan and France in GRiSP, which both have an internationally oriented rice R&D system. France and Japan have contributed greatly to the development of GRiSP and play a coordinating role through Cirad, IRD, and JIRCAS (sections 4.4.1 and 4.4.2).

4.4.1 Japan

Japan is a strategic partner for GRiSP because it has one of the largest rice research and development systems in the world, with a long history of outstanding achievements. Numerous Japanese rice researchers work internationally, including in projects with IRRI, AfricaRice, and CIAT as well as in long-term bilateral rice sector investments in many countries of Asia and Africa.

JIRCAS, an incorporated administrative agency under the Ministry of Agriculture, Forestry, and Fisheries (MAFF) of Japan, is a founding and coordinating partner of GRiSP and acts as a gateway for GRiSP to the Japanese rice research community. JIRCAS acts as the secretariat of the GRiSP Coordinating Committee in Japan. The mission of JIRCAS is to improve technologies for agriculture, forestry, and fisheries in developing regions. It conducts a number of joint research projects on an equal footing with collaborative partners in 25 countries of Asia, Africa, and Latin America. Among the more than 100 JIRCAS researchers, 23 work on important rice research issues such as molecular biology, breeding, agronomy, modeling, water management, food science, and socioeconomics (as of 2010). The improvement of rice production in Africa also has high priority for JIRCAS as it plays a major role in CARD (Coalition for African Rice Development), together with IRRI and AfricaRice. Existing and new mechanisms will be employed to enhance collaboration with the wider Japanese rice research community and thus connect its strengths in advanced research to products being developed in GRiSP for poor rice farmers worldwide. This includes (1) participation in joint GRiSP activities/projects, (2) advanced research funded and conducted primarily in Japan but with a link to GRiSP, and (3) research collaboration through the exchange of staff and graduate students. GRiSP cooperates with about 15 Japanese research and development organizations, institutions, and universities. Key areas for research collaboration with JIRCAS, various other research institutes belonging to the national agricultural research system (e.g., NIAS, NIAES, NARO-NICS), and Japanese universities are functional genomics (PL 1.2–1.4); molecular rice breeding for abiotic and biotic stress tolerance (PL 2.2–2.4); temperate rice systems, including the Temperate Rice Research Consortium (PL 2.4); climate change (adaptation and mitigation, PL 3.4); new products from rice (PL 4.2 and 4.3); and socioeconomic research (PL 5.1 and 5.3).

4.4.2 France

In France, Cirad and the IRD are founding and coordinating partners of GRiSP and act as the gateway to the larger French national agricultural research and extension community. Cirad works with developing countries and regional and international organizations to tackle international agricultural and development concerns. Its operations, from field to laboratory and from a local to global scale, are based on development needs. Its 800 scientists have joint operations with more than 90 countries. Cirad provides the national and global scientific communities with extensive research and training facilities in Montpellier and in several platforms overseas. Rice is the first target crop (commodity) for some 60 Cirad scientists, of whom 25 are outposted in Africa, Asia, and Latin America. As a member of Agreenium, Cirad is also the gateway for mobilizing other French agriculture-related research and higher education institutions for the benefit of rice science. In GRiSP, Cirad and its partners mainly focus on rice breeding and the associated "-omic" sciences (Themes 1 and 2); unified frameworks for analysis of the environmental impact of rice production systems and their adaptation to climate change (Theme 3); sustainable water and land management, conservation-agriculture-based rice cropping systems, and modeling tools at various scales (Theme 3); grain quality issues, and innovative use of rice co-products, including "green chemistry" (Theme 4); and information systems and analysis of public policies and dynamics of rice commodity chains (Theme 5).

IRD is a public science and technology research institute, reporting to the French ministries in charge of research and development cooperation. It is strongly involved in the national research system, including universities and other advanced research institutes (INRA, CNRS, INSERM). Working throughout the tropics, IRD conducts three missions (research, training, and consultancy) in close cooperation with its numerous partner countries to contribute to the economic, social, and cultural development of the countries of the South. IRD has outposted staff at CIAT and has important facilities and equipment in dedicated research centers in France and in French overseas territories, and also in 22 intertropical countries. IRD has a long research experience in rice in the domains of genetic resource preservation and evaluation mainly in Africa and in collaboration with CGIAR centers. In GRiSP, IRD's contribution focuses on Themes 1 and 2, particu-

larly the development of interspecific hybridization and prebreeding for gene discovery, genome analysis of African rice species *O. glaberrima*, and cloning of genes of interest, with emphasis on pathogen resistance genes.

4.5 Civil society organizations

Civil society, including nongovernment organizations (NGOs), farmers' associations, farmer clubs, and many others, is widely involved at the downstream end of rice production and value chains and is an essential partner for dissemination. It also plays an important role in providing feedback to researchers and policymakers on setting the right research and investment priorities in order to meet the demands of poor women and men farmers. GRiSP currently has active partnerships with well over 100 CSOs in more than 20 countries, mainly as development partners in Themes 2, 3, 4, and 6. Some international NGOs, such as the World Wildlife Fund and Catholic Relief Services, are also involved in more upstream aspects of rice development and environmental concerns. Generally speaking, CSOs have a comparative advantage in operating at the grass-roots level and are thus well placed to ensure full participation of farmers and other stakeholders in GRiSP activities. Their participation is crucial to achieve impact. Such organizations also complement capacity building for a voice at the grass roots. ROPPA (the Network of Farmers' and Agricultural Producers' Organizations of West Africa) has observer status at AfricaRice's Council of Ministers and National Expert Committee meetings.

GRiSP seeks to expand its partnerships with the CSO sector, including global, regional, national, and local NGOs, farmers' associations, and other groups representing the agricultural, social, and environmental sector. In all GRiSP regions, GRiSP seeks to engage actively with leading CSOs in implementing grass-roots-level development work, as captured in Theme 6. GRiSP will seek more interaction with the CSO sector on effective mechanisms for priority setting and collaboration.

4.6 The private sector

The expansion of the rice seed sector is leading to an increased diversification of rice R&D systems. The private sector is making substantial investments in specific rice R&D areas such as gene discovery and molecular breeding for hybrid rice development, crop protection, new machinery, and rice processing/new products from rice. It is thus generating intellectual property (IP) that could also be of advantage to the public sector. Moreover, private companies are developing and operating increasingly sophisticated crop advisory systems and delivery channels through which it may also be possible to disseminate public-sector know-how. For example, a number of large international companies in the business of selling seeds, agrochemicals, or farm machinery disseminate GRiSP's alternate wetting and drying technology to farmers through their own advisory networks to help them save irrigation water (Fig. 4.2). Hence, new formal research partnerships and contractual relationships are emerging among the public and private sector. GRiSP partners currently include over 110 private companies or organizations representing different areas of the private sector. More than 60% of those are small to medium companies operating nationally or locally, collaborating within GRiSP on adapting and disseminating new technologies or information to farmers and others. These partnerships cut across all GRiSP themes, from upstream gene discovery research in Theme 1 to partnering with numerous small local companies and entrepreneurs on delivery (Theme 6). Key models for public- and private-sector collaboration within GRiSP follow:

- Joint bilateral research implemented through Scientific Know-how and Exchange Programs (SKEP), focusing on research areas that are part of the GRiSP mission and are of mutual interest, IP sharing, scientist-to-scientist interaction, and capacity building for young scientists. Such SKEPs do not involve commercialization agreements, that is, the outcomes of this work are available to both parties. Examples include SKEPs between IRRI and DuPont (Pioneer), Bayer CropScience, Syngenta, and Devgen.
- Multilateral, public- and private-sector consortia with innovative, self-sustained business models for such partnerships and managing intellectual property in the interest of all participants and to the benefit of poor rice farmers and consumers. An example for this is the international Hybrid Rice Development Consortium (section 5.1.5), which consists of 32 seed companies and 32 public-sector institutions (as of the end of 2012).
- Licensing of intellectual property from the private sector to the public sector and vice versa.

This is an emerging area and it requires clear guidelines, including for product stewardship. GRiSP, in accordance with the IP policies of the participating centers and institutions, supports the development of transparent mechanisms for sharing of IP to the benefit of poor farmers and consumers. This will also include guidelines for joint licensing of IP, in cases where several partners may have contributed to a discovery or development of a product.

- Local delivery partnerships that capitalize on expertise and networks for delivering products and services effectively and efficiently to farmers. By working with private-sector partners on a nonexclusive basis, another channel for delivering public research solutions is enabled. In such cases, GRiSP research partners provide initial technical support and assistance with capacity building for delivering new technologies, whereas private companies, like other partners, use their own resources to deliver these technologies to farmers and also provide feedback for further improvement. In South Asia, for example, GRiSP collaborates closely through the CSISA and STRASA initiatives (sections 5.3.1 and 5.3.2) with numerous private companies involved in new agribusiness for providing farm services and knowledge—seeds and other inputs, farm machinery, customized services (crop establishment, harvesting), market information, facilitation of finance, contract farming, and other commercial services.

4.7 CGIAR centers

Besides IRRI, AfricaRice, and CIAT, several other CGIAR centers collaborate in GRiSP, for example:

- IFPRI participates in research on food supply-demand modeling, adoption studies, cereal systems in South Asia, aspects related to nutrition and nutritionally enhanced crops, value chains, and policy concerns (Themes 2, 3, 4, and 5).
- CIMMYT, ILRI, and IFPRI participate in research on improving cereal-based systems in South Asia (CSISA, section 5.3.2), including diversification (maize, pulses) and crop-livestock interactions (Themes 3 and 6).
- WorldFish and IWMI collaborate with GRiSP in projects on coastal zones and other aquatic systems that involve rice and fish through the CGIAR Research Programs "Water, Land, and Ecosystems" and "Aquatic Agricultural Systems."

Bas Bouman, IRRI

Fig. 4.2. A private-sector manufacturer of farm machinery advertises a transplanting machine (left panel) and disseminates information on the alternate wetting and drying technology using field-water tubes (right panel) to help farmers save water during an exhibition at Thailand's First International Rice Science Conference, Bangkok.

4.8 International organizations

GRiSP includes collaboration with international organizations and centers such as FAO, the Centre for Agricultural Bioscience International (CABI), the International Center for Development-oriented Research in Agriculture (ICRA), and the Coherence in Information for Agricultural Research for Development (CIARD) movement. Collaboration with FAO focuses on rice information systems (Theme 5), knowledge management for dissemination and innovative ICT approaches (Theme 6), and large-scale dissemination of new seeds and management technologies in Asia and Africa (Theme 6). Collaboration with the CIARD focuses on virtual extension and communication networks. Collaboration with CABI focuses on unique global ICT products and capacity building for plant health (Themes 3, 5, and 6). GRiSP contributes rice content

to CABI's Plantwise initiative and plant health clinics. Partnership with ICRA focuses on capacity building for persons working in multistakeholder platforms for technology development or dissemination (Theme 6).

4.9 Farmers

Rice farmers (women and men) are the most important ultimate beneficiaries of GRiSP (along with other stakeholders in the rice value chain such as millers, processors, traders, and rice consumers at large). GRiSP collaborates with farmer organizations in several of its projects such as STRASA and CSISA (sections 5.3.1 and 5.3.2), and works directly with farmers in many of its development-oriented activities (Box 1). At the beginning of new project activities, farmers are involved in needs and opportunity assessments.

In developing new rice varieties, farmers and farming communities are involved through participatory varietal selection (PVS, in which women and men farmers express their preference for new lines on their own terms; Box 2). Farmer participatory research is part and parcel of most activities aimed at developing suitable, pro-poor, and gender-sensitive crop and natural resource management technologies (e.g., nutrient management, water management, pest control, etc., in Theme 3). Farming communities are involved in developing or facilitating community-based activities, such as seed banks, community-based rodent control systems, and community-based water management. In many countries in Asia (e.g., Bangladesh) and Africa, women are specifically involved in postharvest activities such as storing, cooking, processing (par-

Box 1. Farmer participatory research for development

An example of successful farmer participatory research for development is provided by GRiSP's activities in Sulawesi, Indonesia, in a combined ACIAR-funded project and the Irrigated Rice Research Consortium. First, a baseline survey was conducted in target villages to document the knowledge level and sources of information on crop management options, current farming practices, yield levels, and income generated from rice production. Next, farmer planning workshops were conducted to discuss the field problems and agronomic constraints gathered during the surveys, and to identify, discuss, and prioritize possible solutions. Alternative technologies for benchmarking and testing in farmers' fields were selected that included saving water using alternate wetting and drying, integrated pest management to control stem borer and other insect pests, storing of rice seeds using the IRRI Super Bag, direct seeding of rice using a drum seeder coupled with appropriate weed management, ecologically based rodent management, and two approaches to fertilizer management. At the end of each cropping season, farmers participated in a meeting with the scientists to discuss the results of the field trials and to decide on the next season's activities. New field trials were added depending on the outcome of these meetings. During the second cropping season, season-long training of farmers on integrated crop management for high-yielding and profitable rice production was implemented following the farmer field school approach. After evaluating the adapted crop management options in the field trials for two cropping seasons, the farmers decided these were ready for integration in larger demonstration plots in the third cropping season. After that, the final project meeting was conducted to summarize the outcomes and to plan for scaling up and scaling out activities to other regions in Indonesia.

Source: Final report "Increasing Productivity in South and Southeast Sulawesi " ACIAR-funded project SMAR 2007/216, 2011, ACIAR, Canberra, Australia.

Grant Singleton, IRRI

Farmers in Sulawesi discussing constraints and possible solutions with project agronomists.

Box 2. Participatory varietal selection

In conventional variety testing programs, breeders choose the rice lines or genotypes that will eventually be forwarded to national rice selection programs for release to farmers. Most if not all steps in the testing process are carried out at the research station and breeders decide which traits are important. In the system of participatory varietal selection (PVS), however, farmers are involved in the selection of new plant materials developed from plant breeding programs. Such materials usually include released cultivars, varieties in advanced stages of testing, and advanced breeding lines. In PVS, farmers are given near-finished or finished products to test in their fields and then they give feedback to the breeders. PVS trials are conducted on-farm and under the complete management of farmers, and hence provide information about the performance of new varieties under the real conditions that farmers face. PVS trials include formal steps in which farmers express their opinions and preferences about the varieties under evaluation. Farmers' opinions are sought on both production and end-use traits, using tools that can emphasize the traits important to them.

Rama Raman, AfricaRice

Female rice farmers in Africa engaged in participatory varietal selection evaluate new rice germplasm "on their own terms."

Source: Paris TR, Manzanilla D, Tatlonghari G, Labios R, Cueno A, Villanueva D. 2011. Guide to participatory varietal selection for submergence-tolerant rice. Los Baños (Philippines): International Rice Research Institute. 111 p.

boiling in Nigeria), and selling, and GRiSP activities focus on developing technology options that suit their needs (Themes 4 and 6).

5 Purpose-driven partnerships

GRiSP embeds a large number of purpose-driven partnerships, such as consortia, platforms, networks, and time-bound programs and (grant) projects. Many of these partnerships predate the founding of GRiSP while some were established recently as new GRiSP initiatives. Currently, GRiSP has more than 200 time-bound bilateral grant projects that each involve a number of partners with well-defined roles and responsibilities. All these projects and partnership arrangements are aligned with, and contribute to, the product development and outcomes of GRiSP. Nested within GRiSP, however, each of these has its own set of specific objectives, operational framework, and financial (or funding) arrangements. Some partnerships engage in relatively upstream science and are located on the very left-hand side of the impact pathway (Fig. 5.1), others are mainly development-oriented and are located on the right-hand side of the impact pathway, while yet others are a mixture of both and are located in the middle. In this section, GRiSP's main embedded partnerships are described to illustrate the diversity in purpose and arrangements of partnerships in GRiSP. This list is by no means exhaustive but is meant to give a flavor of the diversity of arrangements.

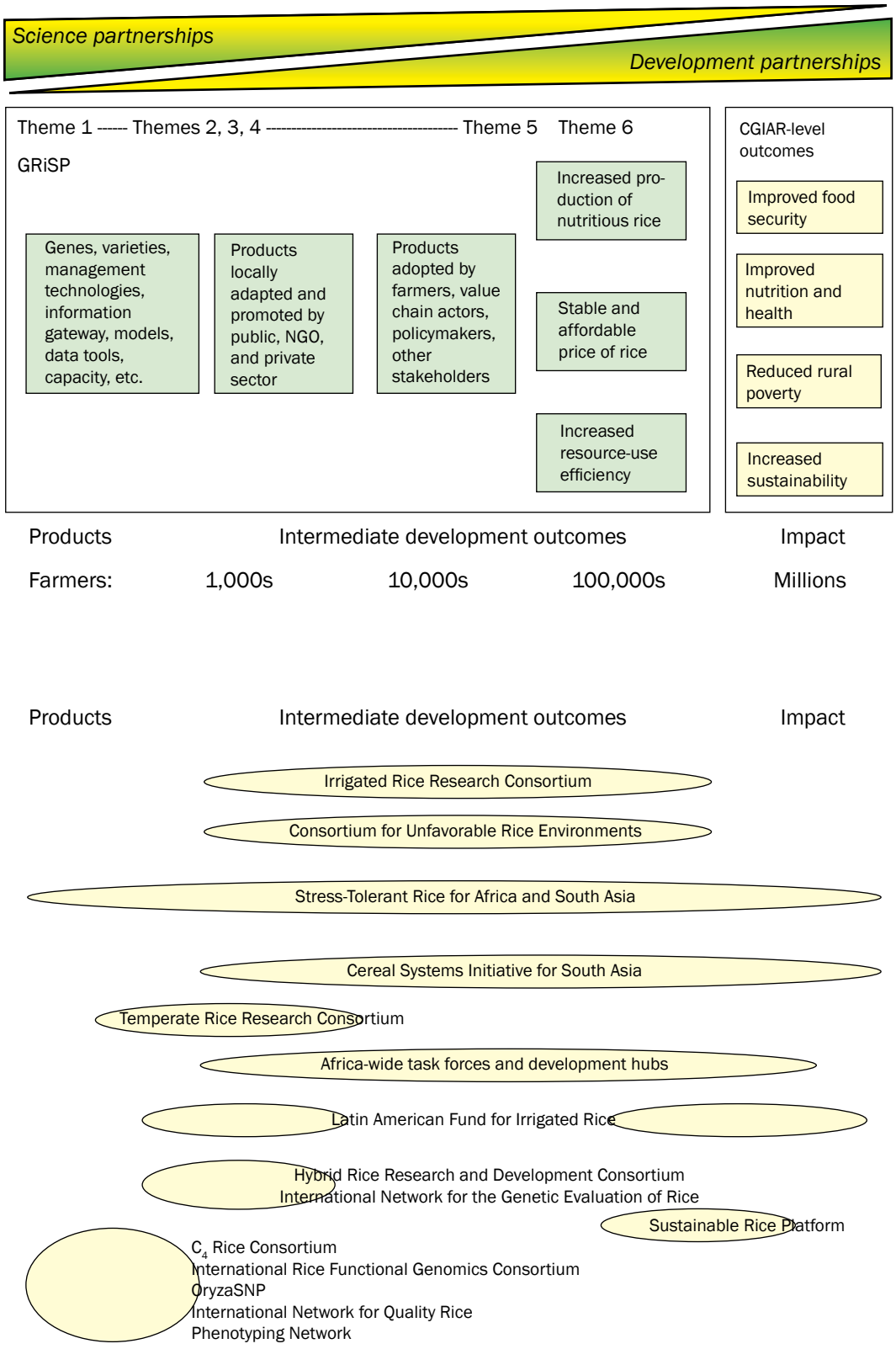

Fig. 5.1. Indicative position of selected GRiSP networks, consortia, platforms, and large projects on the overall impact pathway.

5.1 Regional consortia and networks for development

5.1.1 Irrigated Rice Research Consortium

Established in 1997, the Irrigated Rice Research Consortium (IRRC) provides a framework for partnership between IRRI, NARES, and the private sector in Asian countries (www.irri.org/irrc). The IRRC strives to ensure that Asian rice farmers in irrigated environments benefit from technologies arising from research. It develops partnerships to identify the natural resource management needs of rice farmers, and solutions to their problems, and to facilitate the development, adaptation, and adoption of suitable technologies. The IRRC's vision is to provide a platform of technologies to a regional community of users in Asia to improve livelihoods and increase rice production needed to maintain food security. It aims to scale out successful technology options in partnership with NARES and other stakeholders, strengthen capacity of NARES partners, and foster innovative research on natural resource management of irrigated rice-based cropping systems.

Between 2009 and 2012, the IRRC operated through six thematic work groups: Productivity and Sustainability, Water-Saving, Labor Productivity, Postharvest, Crop Health, and Climate Change. The Postharvest work group has been using the participatory impact pathway analysis (PIPA) approach to identify and mobilize partners for outscaling and upscaling of its research results (Box 3). The steering committee of the IRRC is composed of NARES representatives from

Box 3. Participatory impact pathways analysis

A particularly powerful method to identify and mobilize partners for research-for-development activities is embedded in the so-called PIPA (participatory impact pathways analysis) process (http://boru.pbworks.com/w/page/13774903/FrontPage): *"A project's impact pathway describes how the project will develop its research outputs and who outside the project needs to use them to achieve developmental outcomes and impact. Part of the process of developing impact pathways involves project staff and stakeholders working together to map how knowledge and research products must scale out and scale up to achieve the project's development goals. PIPA begins with a participatory workshop where stakeholders make explicit their assumptions of how their project will achieve an impact. Participants construct problem trees, carry out a visioning exercise, and draw network maps to help them clarify their 'impact pathways.'* "
The network mapping exercise consists of identifying current project partners, but also those who would need to be brought into the project to play vital roles in up- and outscaling processes. The mapping process can also specify the roles each partner is expected to play, and identify means of engagement.

Postharvest unit, IRRI

Postharvest PIPA Workshop. A group of value-chain stakeholders drawing a map of the postharvest network and discussing roles and responsibilities of each partner (left), and their final product (right) showing project partners and those actors that need to be influenced to achieve the long-term project goals.

Asian member countries and donor representatives (Fig. 5.2). It provides direction and guidance to the consortium and is its main policy-making body.

By the end of 2012, the IRRC comprised more than 30 partner institutions in nine countries: Bangladesh, Cambodia, China, Indonesia, Lao PDR, Myanmar, the Philippines, Thailand, and Vietnam. However, the main bilateral funding for the IRRC stopped at the end of 2012, and it will be reorganized as a partnership platform under GRiSP to facilitate knowledge exchange and cross-project and cross-country learning.

5.1.2 Consortium for Unfavorable Rice Environments

The Consortium for Unfavorable Rice Environments (CURE) is a regional platform for partnerships among institutions led by IRRI and NARES from South and Southeast Asia (www.irri.org; click on Partnerships to find CURE). CURE focuses on rice farming systems in which low and unstable yields are commonplace and extensive poverty and food insecurity prevail. It is a platform within which NARES and IRRI researchers partner together with farmers and extension workers to tackle key problems at sites representative of the diverse ecosystems. Its strategy involves on-site farmer participatory research linking scientists from NARES, international research centers, and advanced research institutes using a multidisciplinary approach for technology generation, validation, and dissemination.

CURE also closely collaborates with local government units and nongovernment organizations to disseminate technologies over a wider area. CURE-facilitated research is conducted within multidisciplinary working groups. These groups meet regularly to review and plan research activities, identify and test suitable technologies, prepare project proposals, monitor research activities, and report progress. Oversight for CURE is provided by a steering committee with senior members from NARES partners from the participating countries.

At the end of 2012, the membership of CURE comprised 26 institutions in 10 countries: Bangladesh, Cambodia, India, Indonesia, Lao PDR, Myanmar, Nepal, the Philippines, Thailand, and Vietnam.

5.1.3 Temperate Rice Research Consortium

The Temperate Rice Research Consortium (TRRC) aims to overcome production constraints in temperate rice-growing areas through collective research efforts (www.irri.org; click on Partnerships to find the TRRC). The constraints addressed include both biotic and abiotic stresses, yield potential, grain quality and nutrition, and water and nutrient management. The TRRC was founded to collaborate on research, training, and technology generation activities designed to meet mutually agreed upon objectives. It specifically aims to

- Provide an international platform and mechanism that supports research and strengthens the

Joel Janiya, IRRI

Fig. 5.2. Annual workshop and meeting of the steering committee of the Irrigated Rice Research Consortium (IRRC), Vientiane, Laos, 2012.

partnership to promote the application of suitable technologies and information to improve sustainable rice production.
- Serve as a platform for identifying and prioritizing concerns of temperate rice research in temperate environments and high-altitude areas in the tropics that generate international/regional public goods for improving rural livelihood.
- Provide logistical support and coordinate NARES-IRRI-ARI strategic research collaboration.
- Promote resource sharing and information exchange among partners.

TRRC-facilitated research is conducted within four thematic working groups that meet annually to review and plan research activities, identify and test suitable technologies, monitor research activities, and share progress.

At the end of 2012, the membership of the TRRC comprised 18 national and international institutions from 16 countries: Australia, Bhutan, Chile, China, Egypt, Japan, Kazakhstan, Korea, Nepal, the Philippines, Russia, Spain, Tanzania, the United States, Uruguay, and Uzbekistan. The TRRC is guided by policies established by the steering committee, which approves the TRRC's operational policies, work plans, and budgets, and monitors the impact of the TRRC. The steering committee consists of high-level administrators/scientists of NARES, IRRI's deputy director general for research, and representatives of major sponsoring organizations.

5.1.4 Latin American Fund for Irrigated Rice

The Latin American Fund for Irrigated Rice (Fondo Latinoamericano para Arroz de Riego; FLAR) was established in 1995 by the concerted efforts of various rice producers' associations from Brazil, Colombia, Venezuela, and CIAT (www.flar.org). In FLAR, rice producers' associations, milling and seed companies, and national public research programs come together with the objective of providing innovative and technological solutions to the needs of rice farmers and the rice industry, and to improve the production of irrigated rice in Latin America. Its main objective is to increase irrigated rice production in a sustainable way, considering parameters of equality, genetic diversity, economical and technical efficiency, profitability, and lower unit costs. FLAR works not only on rice breeding and germplasm exchange but also on the development of other integral parts of the system, including—but not limited to—crop management technologies, postharvest, alternative uses, and grain quality.

FLAR involves all those entities that share the mission of the Fund. Each new member country is represented by one institution of the rice sector. This institution is responsible for ensuring the participation of other entities working to promote rice research, technology transfer, rice production, and marketing. Besides the representatives of the rice institutions, those rice research organizations that share FLAR's mission and related activities to support rice development are welcome to join FLAR.

At the end of 2012, FLAR comprised 27 institutions from both the private and public sector, from Argentina, Bolivia, Brazil, Colombia, Chile, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Peru, Uruguay, Venezuela, and CIAT.

5.1.5 Hybrid Rice Development Consortium

Worldwide, about 13% of all rice grown is hybrid rice—varieties in which seeds of the first generation of crosses have higher yield potential—commercially marketed to farmers. Since the initial release of hybrid rice in the mid-1970s in China, IRRI and its national partners in Asia have led research, development, and use of hybrid rice technology in the tropics for almost 30 years. Many large multinational and smaller national seed companies are now engaged in hybrid rice breeding and commercialization. Thus, the public sector should now focus on fostering public-private partnerships in which public institutions concentrate more on prebreeding, basic research on key traits, information, and capacity building, whereas commercialization is mainly done by small and large private enterprises, which need to have equal access to new traits, hybrid parental lines, pilot hybrid varieties, information, and other technologies developed by the public sector.

For this reason, the international Hybrid Rice Development Consortium (HRDC) was established by IRRI in 2008 as a new model for public-private partnerships (www.irri.org; click on Partnerships to find the HRDC). Its current membership (December 2012) stands at 32 private-sector and 32 public-sector institutions. Private-sector members of the HRDC provide the demand-driven feedback for IRRI's hybrid rice research, but also the financial support needed for sustaining it, in collaboration with IRRI's national partners. They re-

ceive the products of this research through fee-based, nonexclusive licensing mechanisms, whereas the public sector continues to have free access. This has allowed IRRI to double its hybrid rice breeding capacity. HRDC members can also participate as sponsors of specific projects and seek bilateral collaboration with IRRI through Scientific Know-how and Exchange Programs (SKEPs), which focus on joint research and capacity building. GRiSP will extend such partnerships with the aim of providing farmers with more and better hybrids, quality seed, and knowledge and services provided by both the private and public sector. In this way, GRiSP will also contribute to the emerging hybrid rice sector in Africa and Latin America.

In Latin America, hybrid rice has the potential to increase productivity but it needs to meet high grain quality standards, have a high yield potential, and be adapted to conditions of direct seeding (both seed and grain production). For this purpose, the Hybrid Rice Consortium for Latin America (HIAAL) was created in 2012 by CIAT and 13 FLAR (section 5.1.4) members. Each FLAR member represents one country. Some of them are public institutions such as IRGA from Brazil, INIA from Uruguay, INIA from Chile, and INTA from Argentina; others are seed companies such as Copra S.A. and Pilagá S.A. from Argentina, Hacienda El Potrero from Peru, Senumisa from Costa Rica, Secosa and Conagro from Panama, and Genarroz from the Dominican Republic; and others are farmers' organizations such as Fedearroz from Colombia, ACA from Uruguay, Fundarroz from Venezuela, ANAR from Nicaragua, and the Consejo Mexicano del Arroz from Mexico. In the HIAAL, CIAT is responsible for the initial development of parental lines and experimental hybrids, and the partners are responsible for testing, release, seed production, and commercialization. To encourage the use of elite locally adapted proprietary lines, a royalties system was established that recognizes the contribution from each parent in a hybrid. Each member of the consortium pays an annual fee according to the size of the rice sector it represents. From this payment, a member receives an annual nursery with experimental hybrids, F_1 seeds for the initial stages of testing, parental seeds for local production of F_1 seeds in the case of near-to-release hybrids, and training on hybrid breeding and seed production.

5.1.6 Africa-wide Rice Task Forces

In Africa, NARES are key partners in research priority setting and implementation of research for development activities. Collaboration is reinforced through the establishment of task forces, responding to certain priority areas. Task forces aim to build critical research mass regionally and nationally and adopt a systematic collaborative approach to rice research for development. For example, the Africa-wide Rice Breeding Task Force focuses on the two aspects of speeding up the process of evaluation for potential new varieties and rebuilding Africa's capacity in rice breeding (Fig. 5.3). It also answers the call for a multienvironment testing network for Africa that is an integral part of GRiSP. AfricaRice facilitates these task forces.

The following task forces have been or will be established:

- Rice Breeding Task Force (Themes 1 and 2).
- Rice Agronomy Task Force (Theme 3).
- Rice Processing and Value Addition Task Force (Theme 4).
- Rice Mechanization Task Force (Theme 3).
- Rice Policy Task Force (Theme 5).
- Gender in Rice Research and Development Task Force (Theme 5, cross-cutting).

5.1.7 Africa-wide Rice Sector Development Hubs

In Africa, GRiSP's research outputs (products) will be integrated in Rice Sector Development Hubs ("good practice areas") to achieve development outcomes and impact (Fig. 5.4). Rice Sector Development Hubs involve large groups of farmers (1,000–5,000) and other value-chain actors, such as rice millers, input dealers, and rice marketers. These hubs are testing grounds for new rice technologies and for new institutional arrangements (contracting) between value-chain actors. Partners pursue a "proof of concept" approach to rice value-chain development, productivity improvement, and sustainable management of natural resources in rice-based systems. The objective is to produce rice or rice-based products that respond to consumer preferences in urban and rural markets in quantities that are of interest to rice traders, who would usually import such products. Hubs represent key rice ecosystems and different market opportunities across sub-Saharan Africa and will be linked to major national or regional rice development efforts to facilitate broader uptake of rice knowledge and tech-

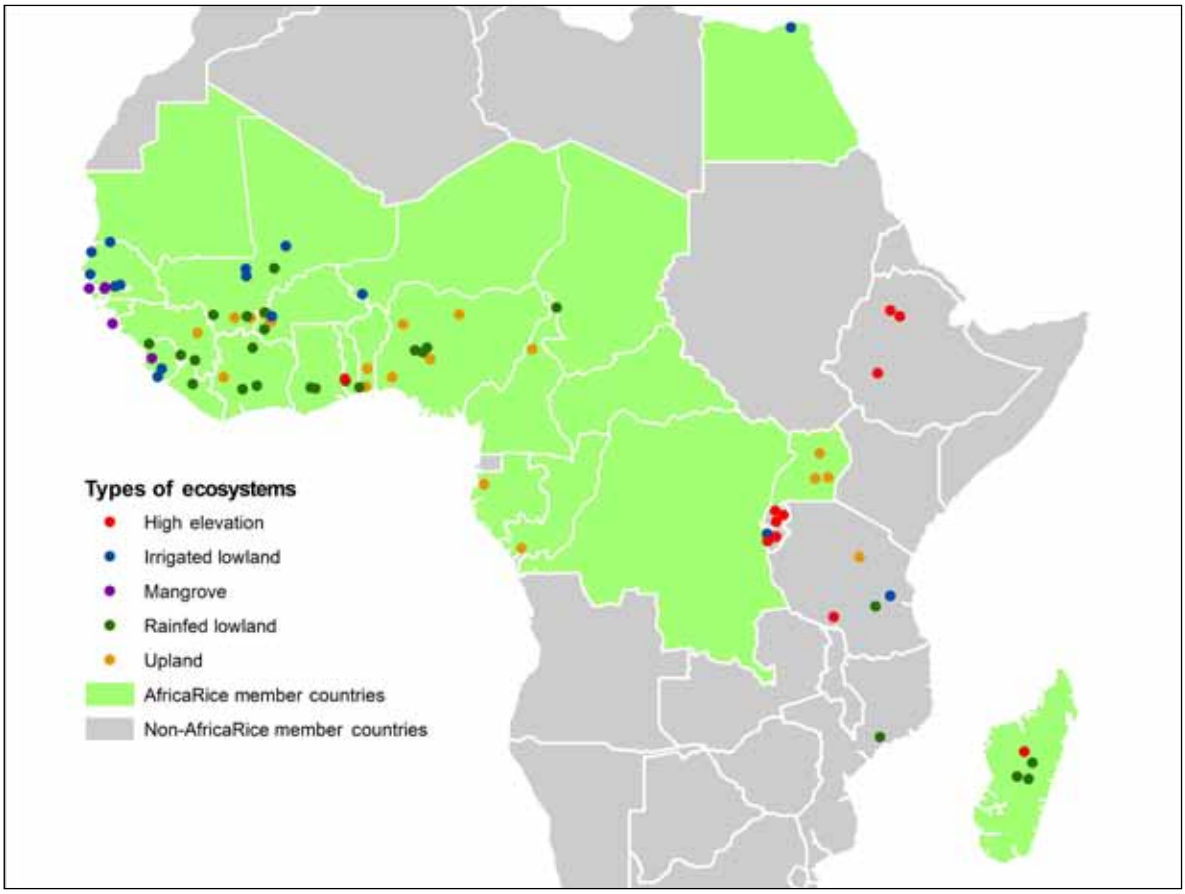

Fig. 5.3. Africa-wide Rice Breeding Task Force, as of November 2012.

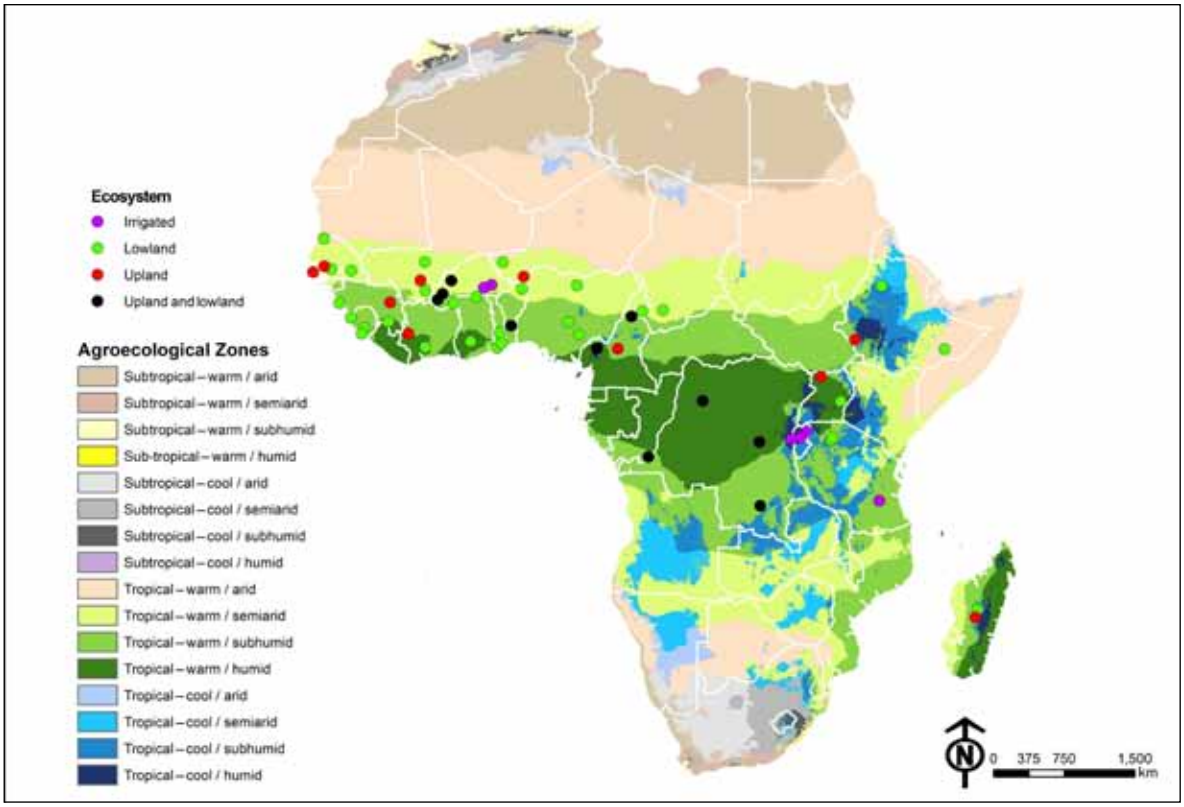

Fig. 5.4. Rice Sector Development Hubs in Africa, according to rice ecosystem: lowland rice, upland rice, and mixed lowland and upland rice. Hubs as of November 2012.

nologies. Care is taken that women and youth are not marginalized, but, on the contrary, strengthened in the process of rice value-chain development. At least 30 Rice Sector Development Hubs will be established across Africa by 2020.

Civil society organizations (CSOs) such as Réseau des organisations paysannes & de producteurs de l'Afrique de l'Ouest (ROPPA) and East Africa Farmers' Federation (EAFF), and major NGOs such as Catholic Relief Services, Sasakawa Global 2000 (SG2000), and Songhai will be involved in technology adaptation and wide-scale diffusion in and beyond the Rice Sector Development Hubs, and will provide feedback to researchers and policymakers on technology performance and research and investment priorities. CSOs have a comparative advantage in operating at the grass-roots level and are thus well placed to ensure full participation of farmers and other value-chain stakeholders.

Collaboration with the private sector may involve contributions to strategic and applied research, or to "proof of concept" work in the Rice Sector Development Hubs. This will include companies involved in farm inputs (seeds, farm machinery), credit provision, processing, and marketing. Private companies will also serve as technology diffusion channels. This will require new formal research partnerships and contractual relationships between the public and private sector, and due consideration of issues related to intellectual property rights.

5.1.8 Regional Rice Research and Training Center for West and Central Asia

Rice is an important food crop in the West and Central Asia region and demand for rice is rising fast. Since 1980, rice consumption nearly tripled to 9 million tons in 2009, whereas total rice production that year in the area stood at around 5 million tons only. IRRI projects that rice consumption in this region will increase to 12 million tons by 2020 and 16.6 million tons by 2035. Hence, this region is among the fastest growing worldwide in terms of rice demand.

The Regional Rice Research and Training Center for West and Central Asia (RRRTC-WCA) was established in September 2010 at the Rice Research Institute of Iran (RRII) to serve as a regional hub for rice science and development. The RRRTC also includes satellite network locations for rice research in partnership with other key countries in the region. The geographic focus is on the rice-producing countries of West and Central Asia: Afghanistan, Iran, Iraq, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan. Most of them are also member countries of the Economic Cooperation Organization (ECO; www.ecosecretariat.org), which has its secretariat in Tehran. The mission of the regional center and its network of research activities is to conduct advanced rice research and provide training to rice scientists and practitioners from the target countries, with an emphasis on new production technologies that will be required to adapt rice production systems in the region to climatic extremes and climate change. The regional center is expected to become a globally important facility for crop improvement, crop and resource management research, climate change research, and training within the larger GRiSP context.

The RRRTC structure consists of a Technical Management Committee (TMC), a coordinator, and an office. The TMC will be composed of fully authorized representatives of all member countries in the region and a representative from IRRI. The TMC will be responsible for overall management of the Center's research and training agenda.

5.2 Global consortia, networks, and platforms

On a global scale, various networks connect hundreds of scientists from many institutions and countries, mostly engaged in more upstream research and product development, though some also include a more downstream development component. Many of them predate GRiSP but have been incorporated into GRiSP's structure as they directly contribute to product development and/or to product delivery. A brief description of the most important consortia, networks, and platforms follows.

5.2.1 International Network for the Genetic Evaluation of Rice

The International Network for the Genetic Evaluation of Rice (INGER) is a global model for the exchange, evaluation, release, and use of genetic resources under the International Treaty on Plant Genetic Resources for Food and Agriculture (http://seeds.irri.org/inger). Established in 1975, INGER is a consortium of NARES of rice-growing countries and international agricultural research centers, including GRiSP's coordi-

nating CGIAR centers IRRI, AfricaRice, and CIAT. Since its inception, INGER is credited for the release of 667 varieties in 62 countries, resulting in economic benefits estimated at US$1.4–1.6 billion. Specific objectives of INGER are to

- Make the world's elite breeding and genetic resources available to all rice scientists for direct use or in crosses within breeding programs.
- Provide rice scientists with the opportunity to assess the performance of their own advanced breeding lines over a wide range of climatic, cultural, soil, disease, and pest conditions.
- Identify genetic resources with resistance to major biotic stresses and tolerance of abiotic stresses.
- Monitor and evaluate the genetic variation of pathogens and insect pests.
- Serve as a center for information exchange on how varietal characteristics interact with diverse rice-growing environments.

Over the years, INGER has become a regular component and a constant reliable source of elite breeding material for national and international rice improvement programs. On average, about a thousand genetically diverse materials are evaluated yearly under different rice ecosystems, and under different biotic and abiotic stresses. More than 600 experiment stations in 80 countries participate in these annual evaluations.

5.2.2 International Network for Quality Rice

The International Network for Quality Rice (INQR) aims to bring new science to traits of quality, to standardize the measure of each trait, and to identify new traits of physical, sensory, and nutritional quality (www.irri.org/inqr). Its members include NARES and advanced research Institutes that work on rice through research, quality evaluation, breeding, or the manufacturing of equipment (private sector). As such, the INQR connects NARES researchers with many advanced research institutes and the private sector.

At the end of 2012, the INQR comprised 110 members operating in all major rice-producing countries of the world.

5.2.3 Phenotyping Network

Future molecular rice breeding will draw from vast public libraries of genes and alleles for second- and third-generation marker-assisted backcrossing (MAS) to produce new rice varieties with improved traits. Though genotyping (the description of a plant's genome) is making rapid advances, rapid and large-scale phenotyping (the description of the physical appearance or biochemical characteristics of plants) is currently the bottleneck to the discovery of useful genes and alleles. No single institution can muster all the environments that rice is globally exposed to, nor all the technical capacity and resources needed to phenotype the diverse germplasm that molecular breeding will draw from or produce. Hence, the Phenotyping Network was established under GRiSP in March 2010, with the aim to discover and characterize new genes and alleles in the genome of cultivated rice that will potentially contribute to improving yield potential and adaptation to environmental constraints, including those related to changing climate. To achieve this goal, agreed-on panels of genotypes representing the existing genetic diversity are phenotyped in the field and in controlled environments for multiple traits of interest, through a multipartner consortium committed to sharing resources and results.

At the end of 2012, the Network's members were IRRI, CIAT, AfricaRice, Cirad, IRD, Embrapa, CAAS, PhilRice, Cornell University, and Syngenta.

5.2.4 C_4 Rice Consortium

The C_4 Rice Consortium has the specific objective to develop rice that operates with a C_4 photosynthesis process instead of its current C_3 process (http://c4rice.irri.org). This "supercharging" of the rice plant is expected to increase yield by 25–50% and hence make a huge contribution to increased rice production and improve the lives of billions of poor people in the developing world. The C_4 consortium is a group of multidisciplinary scientists from advanced institutions around the world, organized in the following groups:

- Bioinformatics: The aim of this group is to provide a web portal for the C_4 consortium to allow free exchange of information between the research groups, to act as a repository for information generated by the consortium, to provide a database of C_4 resources for use by the consortium, and to develop interrogation tools for rapid analysis of bioinformatics data. This group is also responsible for bioinformatics and systems biology analysis of publicly available data and data generated within the project.

- Genetic Screening: This group aims to identify genes associated with C_4 photosynthetic properties by screening mutagenized sorghum plants and looking for revertants to a C_3 phenotype and to examine gene activation-tagged lines of rice for gain-of-function C_4 properties. Various phenotyping experiments are being used, including anatomical, biochemical, and physiological assays that can be rapidly applied to a large number of plants.
- Molecular Engineering: The aim of this group is to generate resources that allow components of the C_4 pathway to be integrated into rice. This involves identifying promoters that generate mesophyll- or bundle sheath-specific accumulation of proteins, investigating whether small RNAs are involved in cell-specific accumulation of photosynthesis proteins in C_4 leaves, building up the known components of the C_4 pathway in rice, and manipulating expression of a transcription factor known to be involved in controlling photosynthesis gene expression.
- Molecular Physiology: This group aims to characterize at a molecular, biochemical, and physiological level the precise effects of mutation, gene activation, and gene insertion on the photosynthetic function of sorghum and rice plants.

At the end of 2012, the C_4 Rice Consortium included 17 advanced research institutes from nine countries.

5.2.5 International Rice Functional Genomics Consortium and the OryzaSNP Consortium

The International Rice Functional Genomics Consortium (IRFGC) was formed in 2003 following the publication of draft sequences of two rice subtypes by the International Rice Genome Sequencing Project (http://irfgc.irri.org). The consortium facilitates research in postsequencing "functional genomics" and establishes an integrated online network of rice functional genomics databases. The consortium includes member institutes in China and India, as well as IRRI and CIAT.

In 2006, the IRFGC initiated the OryzaSNP Consortium to provide the rice research community with extensive information on genetic variation present within and between diverse rice cultivars and landraces, as well as the genetic resources to exploit that information (www.oryzasnp.org, www.news.colostate.edu/Release/1175). With OryzaSNP, the Institute for Genomic Research, Perlegen Sciences, Inc., and IRRI join forces to unlock the genetic secrets of rice, which could help improve rice crops and alleviate hunger and malnutrition for millions of people. The consortium will focus on the genetic basis underlying important agricultural traits such as the nutritional value and disease resistance of 21 diverse lines, or varieties, of rice by identifying and comparing differences in DNA sequences. The consortium has generated a large fraction of the single nucleotide polymorphisms (SNPs) present in cultivated rice through whole-genome comparisons of 20 rice genomes, including cultivars, germplasm lines, and landraces. The SNP data are entirely public and can be used to identify a collection of SNPs for undertaking whole-genome scans.

5.2.6 International Rice Blast Network

Rice blast (caused by *Magnaporthe oryzae*) is one of the most destructive rice diseases worldwide. Over the years, a new set of differential varieties with monogenic lines that include 23 resistance genes has been developed and released in collaboration between IRRI and JIRCAS. Since 2006, the JIRCAS-led Blast Research Network for Stable Rice Production has used these lines to try to enhance the sustainability of rice production by monitoring resistance against blast disease using a universal "differential system." A differential system is a basic tool for understanding host-pathogen interactions, which consists of rice varieties carrying a single gene for blast resistance and blast isolates differing in corresponding avirulence/virulence genes. The Blast Network works toward the

- Diversification of studies on blast pathogens and resistance in rice varieties.
- Development of new differential varieties.
- Selection of standard differential blast isolates.
- Design of a common evaluation system for pathogenicity of blast isolates.
- Development of a new designation system for blast races.
- Identification of novel resistance genes.

At the end of 2010, the Blast Research Network consisted of nine research centers and one university from six countries, China, Vietnam, Lao PDR, Bangladesh, the Philippines, and Indonesia, in addition to four institutes, IRRI, AfricaRice, the National Institute

of Agrobiological Sciences (NIAS), and JIRCAS. This network collaborates with the Temperate Rice Research Consortium (TRRC) (section 5.1.3).

5.2.7 Sustainable Rice Platform

The Sustainable Rice Platform (SRP), launched in 2011, is a global multistakeholder platform, co-convened by the United Nations Environment Programme (UNEP) and IRRI to promote resource efficiency and sustainable trade flows, production and consumption operations, and supply chains in the global rice sector (Fig. 5.5). The SRP aims to

- Develop and promote a set of globally relevant *principles and best practices* (or a *global standard*) for sustainable rice production (including postharvest practices).
- Develop and promote quantifiable sustainability targets that suit a variety of agricultural, social, and environmental conditions and that are attainable at the farm and landscape/watershed level.
- Develop and promote a set of decision-support systems (a toolbox) for the assessment of rice production practices against an array of biophysical, socioeconomic, and environmental performance indicators.
- Develop and promote the adoption of the developed principles and best practices (or a *global standard*) for sustainable rice production and the sustainability targets by rice producers and participants in the whole rice value chain.

The SRP addresses its objectives through a process of learning among its participants and different stakeholders. The *standard* in combination with the *tools* and *practices* is intended to give guidance to producers and other participants in the rice value chain willing to adopt it. In order to promote uptake, the SRP aims at evolving into a voluntary market transformation initiative as well as into a driver for the creation of different incentive structures in the public or private arena. Moving forward, the SRP will be fully aligned with national, regional, and international programs in the rice sector. Organizations can adhere to the platform by committing themselves formally to contribute, either financially or in kind. At the end of 2012, members were five governments and governmental bodies, 10 research institutes/NGOs, and six international and three Asia-based companies (trade, food processors/manufacturers, input suppliers, and retail).

5.3 (Large) Time-bound projects

GRiSP includes more than 200 bilateral grant projects. Here, a brief description is given of three large (in terms of financial size, volume of work, and number of partners) research for development projects.

5.3.1 Stress-Tolerant Rice for Africa and South Asia

The project Stress-Tolerant Rice for Africa and South Asia (STRASA) began at the end of 2007 with IRRI in collaboration with AfricaRice to develop and deliver rice varieties tolerant of abiotic stresses (drought, submergence, salinity, problem soils) to the millions of farmers in the unfavorable rice-growing environments in sub-Saharan Africa and South Asia (www.strasa.org). STRASA was conceived as a 10-year project with a vision to deliver the improved varieties to at least 18 million farmers on the two continents. The project is

Isagani Serrano, IRRI

Fig. 5.5. In a meeting co-convened by the United Nations Environment Programme (UNEP) and IRRI in Los Baños, Philippines, in 2011, the members of the first advisory committee of the Sustainable Rice Platform sign the inauguration documents (left) and discuss sustainable rice technologies in the field (right).

conducted in 22 target countries: Nigeria, Benin, Senegal, Burkina Faso, Ghana, Guinea, The Gambia, Mali, Côte d'Ivoire, Guinea Conakry, and Sierra Leone in West Africa; Mozambique, Tanzania, Uganda, Ethiopia, Madagascar, Rwanda, Burundi, and Kenya in eastern and southern Africa; and India, Bangladesh, and Nepal in South Asia. These countries have major rainfed rice production areas that are affected by abiotic stresses.

IRRI and AfricaRice use the principle of working with local and multiple actors to achieve sustainable outcomes. They operate through collaboration with government, nongovernment, and private business partners. The partnerships are country-specific. In India, STRASA has moved beyond research organizations and has developed linkages with the Ministry of Agriculture, state governments, mega-schemes of the federal government, international organizations and NGOs dealing with food and livelihood security and climate change, banks, public- and private-sector seed corporations, input providers, and farmer organizations. The project currently has about 200 partners, many of which are involved in seed production. For example, there are 129 recognized partners in seed production in South Asia alone, allowing rapid outscaling of new seeds and information through multiple channels. Indirect and direct co-investments by these partners exceed the funds coming into the project from the supporting donor by far.

5.3.2 Cereal Systems Initiative for South Asia

The Cereal Systems Initiative for South Asia (CSISA) started in late 2008 and was designed as a 10-year project to provide an overall strategy and a new umbrella for contributing new science and technologies to accelerating short- and long-term cereal production growth in South Asia's most important grain baskets (https://sites.google.com/a/irri.org/csisa). It builds on technologies developed and lessons learned from the Rice-Wheat Consortium, the Irrigated Rice Research Consortium (section 5.1.1), and many other investments in agricultural R&D by both the public and private sector. Through creating and facilitating innovative public- and private-sector partnerships in key hubs, the project boosts the deployment of existing varieties, hybrids, crop management technologies, and market information. CSISA focuses initially on nine hubs in areas of Bangladesh, India, Pakistan, and Nepal that represent key intensive cereal production systems. The hubs provide a basis for active learning about mechanisms for rapid adoption and intensification of improved cereal seed and crop management practices, for understanding critical components of public- and private-sector partnerships, and for developing business plans and supporting policies to stimulate private-sector investments (Fig. 5.6). Improved cultivars and hybrids of maize, rice, and wheat selected under conservation agriculture practices will be developed and management concepts for future cereal systems will be designed and evaluated, alongside policy analysis and advocacy, and capacity building at all levels.

At the end of 2012, CSISA involved more than 250 public-sector, civil society, and private-sector partners in the development and dissemination of new rice, wheat, and maize varieties and hybrids, improved

Bhagirath Chauhan, IRRI

Figure 5.6. Focus group discussions with farmers and CSISA project staff bring to light constraints to the adoption of improved rice technologies and identify means of overcoming them, which often include strengthening public- and private-sector engagement in technology delivery. Focus group discussions, Bangladesh, 2011.

cropping systems, resource-conserving management technologies, improved policies and markets, and public-private delivery systems.

5.3.3 Green Super Rice

The project Green Super Rice (GSR) for the resource poor of Africa and Asia, led by the Chinese Academy of Agricultural Sciences (CAAS), aims to develop rice varieties that retain their stable, sustainable yield potential even when grown with fewer inputs or under unfavorable environmental conditions (http://thegsr.org/). Rice production in sub-Saharan Africa and Asia is constantly under pressure of various kinds of stresses, for example, drought, submergence, salinity, limited nutrient input, poor soils, and pest infections. Recent scientific advances achieved by Chinese rice scientists have accelerated the development of new varieties that can withstand drought, flooding, cold weather, and toxic minerals such as salt and high iron. GSR varieties are bred to perform well in the toughest of conditions where the poorest farmers grow rice. Currently, 106 GSR varieties are ready for exchange through the International Network for the Genetic Evaluation of Rice (INGER, section 5.2.1). The project seeks to deliver these varieties to smallholder farmers in eight countries in Africa and eight countries in Asia to an accumulation of 11 million hectares of farmland in the target regions, and to increase annual rice productivity by 13 million tons in these countries. The countries are Liberia, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, and Uganda in Africa; Cambodia, Indonesia, Lao PDR, Vietnam, Bangladesh, Pakistan, and Sri Lanka in Asia; and Sichuan, Yunnan, Guangxi, and Guizhou provinces in China. The GSR project was launched in 2008, was designed as a 10-year project, and involves 18 advanced research institutes and universities in China and 17 NARES partners in Africa and Asia. It also supports the development of the private sector, especially hybrid rice seed companies.

6 Some new GRiSP initiatives

Besides the creation of new partnership arrangements such as the Africa-wide Rice Sector Development Hubs (section 5.1.7), the Regional Rice Research and Training Center for West and Central Asia (section 5.1.8), and the Phenotyping Network (section 5.2.3), GRiSP initiated a few other mechanisms to promote, facilitate, and strengthen partnerships:

- A fund to support new partnership development activities, primarily intended for initializing or strengthening collaboration between GRiSP scientists and potential new research partners. Funds are available to organize workshops or group meetings to develop new partnership ideas, and for individual travel grants to facilitate cross-institute and cross-country learning.
- A fund for New Frontiers Research projects, to be awarded on a competitive basis. This mechanism is used to support innovative, exploratory research in high-priority areas that may lead to breakthroughs in existing GRiSP products, or which may evolve toward becoming full new R&D products of GRiSP in the future. This fund uses open calls that are targeted at advanced research institutes and strategic GRiSP partners.
- The Global Rice Science Scholarships aim to strengthen GRiSP NARES partners by offering young agricultural scientists the opportunity to be experts in a scientific discipline and to have a broader understanding of the global issues affecting rice science for development. Scholarships are competitively awarded to young professionals and students pursuing a doctoral degree in rice science and related systems research in the fields of agronomy, crop physiology, entomology, plant pathology, soil and water science, plant breeding, and the social sciences.

7 Alignment with regional and country priorities

7.1 Country-level alignment

The GRiSP coordinating partners employ several mechanisms to align GRiSP with national rice sector programs and with the priorities and strategies of its main national R&D partners:

- In Asia, IRRI holds country planning meetings every 3 years with most of the Asian countries it collaborates with to align priorities, agree on joint goals and objectives, monitor ongoing joint activities, and develop new ones. These meetings are usually organized through a primary

country partner (e.g., CAAS in China, ICAR in India) but can include many others as well. An example of a recent planning meeting is that between India and IRRI in November 2012, where joint activities with several Indian NARES partners were approved that are directly aligned with GRiSP product development.

- In Africa, the Africa Rice Center is an autonomous intergovernmental association of 24 member countries (as of December 2012), covering West, Central, East, and North Africa. Its objectives, strategy, and research activities are aligned with those of its member states and get approved by the AfricaRice Council of Ministers (Fig. 5.7). An important mechanism for continental-level review and planning of activities is the Africa Rice Congress, which takes place every four years. There is greatly increased awareness that rice has become a strategic commodity to fuel economic growth and to contribute toward hunger and poverty reduction across the continent. Many African countries have embarked on ambitious programs to boost their rice production capacity, most of them as a response to the 2008 rice price crisis. AfricaRice has provided technical support to 21 countries within the framework of the Coalition for African Rice Development (CARD), and other AfricaRice member states not members of CARD, to assist with the design of national rice development strategies. These strategies now need to be turned into concrete action plans to boost the rice sector.
- In Latin America, the main mechanism for coordinating and aligning rice R&D with country priorities and strategies is through the Latin American Fund for Irrigated Rice (FLAR) that includes 15 member countries (section 5.1.4). FLAR meets on an annual basis to discuss priorities, monitor ongoing activities, and develop and approve new ones.

7.2 International and regional fora and development organizations

GRiSP and its partners interact closely with all major regional fora and economic communities that have a major interest in development of the rice sector. It uses these interactions to align its agenda with those of these fora that represent national and regional interests and development priorities. These fora include the following:

- The Council for Partnership on Rice Research in Asia (CORRA), established in 1996 to enhance the effectiveness of the various partnership mechanisms employed in meeting the challenges of the global rice research system (www.irri.org; click on CORRA). The Council is committed to promoting and supporting interdependence, reducing barriers, and collectively changing the perspectives of all partners: research workers and administrators, policymakers, and donors—both inside and outside the region—as they become full partners in the global rice research community. The main objective of CORRA is to guide, facilitate, support, and thereby strengthen the partnership among NARES in Asia, and between NARES and IRRI and other relevant institutions, in an effort to meet the rice research needs of the Asian region. Member countries are represented by senior officials of selected NARES in Asia (currently, there are 16 member countries). Countries are selected based on the importance of rice in their national agricultural plans and for their representation of rice ecosystems. IRRI is represented by its director general. CORRA representatives meet every year to discuss issues and challenges facing the Asian rice industry. The meeting is also a forum where country representatives provide important inputs into the policies that influence the livelihood of rice farmers and consumers and the rice R&D agenda in the region. CORRA had

Rama Raman, AfricaRice

Fig. 5.7. The 28th Ordinary Session of the Council of Ministers of AfricaRice, Banjul, Gambia, 22 September 2011.

served as the steering committee of the International Network for the Genetic Evaluation of Rice (INGER; section 5.2.1) up until 2010. It now acts as an advisory body for GRiSP in Asia.

- Regional fora involved in GFAR (e.g., FARA, FORAGRO, APAARI at the continental level and CORAF and ASARECA in Africa at the subregional level).
- Higher-level political bodies and development initiatives targeting food security and poverty, such as CAADP (NEPAD), CARD, ASEAN, SAARC, and APEC.
- Regional Economic Communities (RECs) such as the Economic Community of West African States (ECOWAS). GRiSP develops active linkages with RECs in regions where rice is considered a priority commodity (such as in West Africa) to assist with policy formulation and building of rice research and extension capacity.
- In Africa, collaboration will also be established with national rice centers of excellence within the framework of the World Bank-funded West Africa Agricultural Productivity Program (WAAPP) in Mali and the East Africa Agricultural Productivity Program (EAAPP) in Tanzania.
- International and regional development funds and banks, including IFAD, the World Bank, ADB, AfDB, and IDAB. Many of those directly contribute as donors to GRiSP through the CGIAR funding mechanisms and through bilateral projects. In addition to that, GRiSP may also provide technical expertise and support to large-scale bilateral or multilateral investments of these agencies in agricultural sector development in high-priority countries.
- In 2008, the Alliance for a Green Revolution in Africa (AGRA) and the Japan International Cooperation Agency (JICA) took the lead to develop a new architecture—the Coalition for African Rice Development (CARD, http://riceforafrica.org)—with the aim to set out an overall strategy and a framework for action to contribute to achieving an African Green Revolution through one increasingly important crop—rice. CARD aims to respond to the increasing importance of rice production in Africa, not by "re-inventing the wheel," but by building on existing structures, policies, and programs of Africa's NARES, the Africa Rice Center (AfricaRice), the Comprehensive Africa Agriculture Development Programme (CAADP), and the Africa Rice Initiative (ARI). Its goal is to support the efforts of African countries to double rice production on the continent to 28 million tons per annum by 2018. CARD steering committee members include three of GRiSP's coordinating institutes—AfricaRice, IRRI, and JIRCAS (others are AfDB, AGRA, FAO, FARA, IFAD, JICA, NPCA, and the World Bank). GRiSP works closely with CARD to support the development and implementation of national rice development strategies in the CARD priority countries. JICA will be a key partner for the development of the rice sector, particularly in Africa (Theme 6), with an emphasis on extension capacity building and small-scale mechanization. GRiSP will provide technical support to CARD projects or will implement them on behalf of or with JICA and national partners.

GRiSP's coordinating partners are members of the above fora, have observer status, or attend regular or special meetings.

Acronyms and abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AfricaRice	Africa Rice Center
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASEAN	Association of Southeast Asian Nations
CAADP	Comprehensive Africa Agriculture Development Program
CAAS	Chinese Academy of Agricultural Sciences
CARD	Coalition for African Rice Development
CIARD	Coherence in Information for Agricultural Research and Development Initiative
CIAT	International Center for Tropical Agriculture
CGIAR	CGIAR is a global research partnership for a food-secure future.
CIMMYT	International Maize and Wheat Improvement Center
Cirad	Centre de coopération internationale en recherche agronomique pour le développement (French Agricultural Research Centre for International Development)
CORAF	Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles (West and Central African Council for Agricultural Research and Development)
CORRA	Council for Partnership on Rice Research in Asia
CSISA	Cereal Systems Initiative for South Asia
CSO	civil society organization
CURE	Consortium for Unfavorable Rice Environments
EAFF	Eastern Africa Farmers Federation
ECO	Economic Cooperation Organization
ECOWAS	Economic Community of West African States
Embrapa	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FLAR	Fondo Latinoamericano para Arroz de Riego (Latin American Fund for Irrigated Rice)
FORAGRO	Foro de las Américas para la Investigación y Desarrollo Tecnológico Agropecuario (Forum of the Americas for Agricultural Research and Technology Development)
GCARD	Global Conference on Agricultural Research for Development
GFAR	Global Forum on Agricultural Research
GRiSP	Global Rice Science Partnership
GSR	Green Super Rice (CAAS-IRRI-AfricaRice project)

HIAAL	Consorcio Híbridos de Arroz para América Latina (Hybrid Rice Consortium for Latin America)
HRDC	Hybrid Rice Development Consortium
ICAR	Indian Council for Agricultural Research
ICRA	International Center for Development-oriented Research in Agriculture
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INGER	International Network for the Genetic Evaluation of Rice
INQR	International Network for Quality Rice
IRD	Institut de Recherche pour le Développement (French Research Institute for Development)
IRRC	Irrigated Rice Research Consortium
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
JIRCAS	Japan International Research Center for Agricultural Sciences
LAC	Latin America and the Caribbean
MAFF	Ministry of Agriculture, Fisheries and Forestry, Japan
NARES	national agricultural research and extension system
NEC	National Experts Committee (24 AfricaRice member countries)
NEPAD	New Partnership for Africa's Development
NGO	nongovernment organization
PL	product line in GRiSP
ROPPA	Réseau des Organisations Paysannes et des Producteurs de l'Afrique de l'Ouest (Network of Farmers' and Agricultural Producers' Organizations of West Africa)
RRRTC-WCA	Regional Rice Research and Training Center for West and Central Asia
STRASA	Stress-Tolerant Rice for Africa and South Asia
TRRC	Temperate Rice Research Consortium
WorldFish	World Fish Center

GRiSP's Mission

GRiSP's mission is to reduce poverty and hunger, improve human health and nutrition, reduce the environmental footprint, and enhance the ecosystem resilience of rice production systems through high-quality international rice research, partnership, and leadership.

Objectives

1: To increase rice productivity and value for the poor in the context of a changing climate through accelerated demand-driven development of improved varieties and other technologies along the value chain.

2: To foster more sustainable rice-based production systems that use natural resources more efficiently, are adapted to climate change and are ecologically resilient, and have reduced environmental externalities.

3: To improve the efficiency and equity of the rice sector through better and more accessible information, improved agricultural development and research policies, and strengthened delivery mechanisms.

Global research themes

1: Harnessing genetic diversity to chart new productivity, quality, and health horizons.

2: Accelerating the development, delivery, and adoption of improved rice varieties.

3: Ecologically and sustainably managing rice-based production systems.

4: Extracting more value from rice harvests through improved quality, processing, market systems, and new products.

5: Enhancing impact through technology evaluations, targeting, and policy options.

6: Supporting the growth of the global rice sector.

CGIAR Research Program on Rice Global Rice Science Partnership

CGIAR is a global research partnership for a food-secure future. Its science is carried out by the 15 research centers of the CGIAR consortium in collaboration with hundreds of partner organizations.

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