



AfricaRice

# TRANSFORMATION OF RICE-BASED AGRI-FOOD SYSTEMS FOR FOOD AND NUTRITION SECURITY IN AFRICA

2030 RICE RESEARCH AND INNOVATION  
STRATEGY FOR AFRICA



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*Cover:* ICT is proving an increasingly valuable tool in many parts of the rice value chain, including in the field; (inset) Rice diversity in the Rice Biodiversity Center for Africa (AfricaRice genebank) (© CGIAR/Neil Palmer/Crop Trust)

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**AfricaRice**

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**CGIAR**

# CONTENTS

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<b>Foreword</b>	<b>ii</b>
<b>Executive summary</b>	<b>v</b>
Vision	v
Mission	v
Value proposition	v
Impact	v
Outcomes	v
Outputs	1
Core research action areas	1
Enablers	3
<b>01. Why a new rice strategy for Africa?</b>	<b>5</b>
1.1. Growing importance of rice and urgency to develop competitive rice value chains	5
1.2. Orientations from the 2011–2020 strategy for boosting Africa’s rice sector	9
1.3. Addressing pervasive and emerging challenges in rice-based agri-food systems	10
1.4. One CGIAR creates an opportunity and confers a new role on AfricaRice	12
<b>02. Deliverables of the new strategy</b>	<b>13</b>
2.1. Vision and mission	14
2.2. Value proposition	14
2.3. Specific objectives	15
2.4. Theory of change and intervention domains	16
2.5. Outcomes	20
<b>03. Cross-cutting issues and synergistic effects</b>	<b>25</b>
3.1. Gender equality and social inclusion	25
3.2. Building capacities	26
3.3. Public–private partnerships	28
3.4. Digitized knowledge management for effective scaling of technologies and innovations	30
3.5. Multiple benefits across multiple impact areas	32
<b>04. Implementing the new strategy</b>	<b>35</b>
<b>05. Tracking progress and measuring impact</b>	<b>49</b>
5.1. Rice strategy key performance indicators 2022–2030	50
<b>Bibliography</b>	<b>51</b>
<b>Annex 1. Tracking progress and measuring impact</b>	<b>53</b>
Rice strategy key performance indicators 2022–2030	53
Indicators — Spheres of control and influence (outputs and outcomes)	54
Indicators — Sphere of interest (impact)	55
<b>Abbreviations</b>	<b>57</b>

# FOREWORD



The Africa Rice Center (AfricaRice)-led Research for Development (R4D) Strategy for Africa was implemented over a 10-year period ending in 2020. It aimed to boost the rice sector in Africa and achieved excellent results and evidenced-based solutions that responded to rice sector challenges in Africa. These outcomes were provided through partnership mechanisms and a network of national and international partners spanning research, policy, development, business, civil society and local communities. These have contributed greatly to improving food and nutrition security and enhancing the lives of millions of Africans.

The African continent, just like the rest of the world, is constantly evolving as it faces continuing systemic challenges that negatively affect efforts to improve food and nutrition security in Africa, including the rice sector. Climate change is arguably the greatest threat to food security, while increasing populations and rapid urbanization continue to put pressure on food systems. The importance of rice as an African daily staple cannot be questioned, and creating opportunities to produce more high-quality rice on the African continent remains an important element of the mission of AfricaRice and its partners. Rice value chain actors are now looking beyond the value chain toward rice-based agri-food systems. Moreover, there is growing consumer demand

for rice products of increasing quality to support economic growth and generate incomes, especially for women and unemployed youth. In addition to providing a staple food, rice should be considered as a basis for the diversification and improvement of diets, and as a vehicle to enrich the nutritional status of the malnourished. There is a need to embrace a transformational approach for rice-based agri-food systems to respond to these demands.

During the last two years of implementation of the 2011–2020 strategy, AfricaRice embarked on an agenda of institutional change and program adjustment in response to the changing demands and circumstances of its external environment. In 2018, the outcomes of an institutional assessment prompted the reframing of the Center’s organizational structure and the definition of new principles for enhancing partnerships with national, regional and global partners, including its sister organization, the International Rice Research Institute (IRRI). In 2020, the Council of Ministers of AfricaRice endorsed a resolution to become a member of One CGIAR.<sup>1</sup> This will change the way AfricaRice conducts research-for-development (R4D) activities. In effect, it will now be guided by the operational, management and governance frameworks of One CGIAR, which tie CGIAR centers to similar rules of procedure. The research agenda of One CGIAR will guide AfricaRice to focus

<sup>1</sup> One CGIAR is a dynamic reformulation of the Consultative Group on International Agricultural Research (CGIAR) partnerships, knowledge, assets and global presence, aiming for greater integration in the face of the interdependent challenges facing today’s world.

its research activities on rice-based agri-food systems geared toward delivering broad access to affordable, sufficient, healthy diets; decent employment; and enhanced food and nutrition security in the face of climate change, while respecting the importance of Africa's valuable and vulnerable ecosystems.

Considering these changes, AfricaRice initiated a revision of its vision and mission, and the development of a new rice research and innovation strategy for Africa. These revisions took account of the new realities, challenges and aspirations of stakeholders in the rice sector in Africa as well as the need to ensure compliance with the One CGIAR 2030 Research and Innovation Strategy. The approach aimed to ensure that AfricaRice and its partner institutions would take a more holistic approach to addressing rice research challenges and endeavor to provide solutions in the context of a global R4D alliance. It also required AfricaRice and its partner institutions to respond more effectively to emerging short- to medium-term challenges, while preparing for coordinated action with other CGIAR centers to address longer-term goals. This new orientation is captured in the 2030 Rice Research and Innovation Strategy for Africa (henceforth referred to as the new strategy).

The development of the new strategy is based on three years of discussions involving the Board of Trustees, Executive Management Committee, program and project leaders, country and regional heads of stations and offices, and professional staff of AfricaRice. Interactions also took place with IRRI and other CGIAR partners, and included the full engagement of, and iterative consultations with, national, regional, continental and international partners. Efforts made to align the new strategy to the One CGIAR 2030 Research and Innovation Strategy have focused on enhancing the sustainability and improvement of the performance of rice-based agri-food systems in terms of their capacity to adapt to and mitigate climate change, and to spur economic

growth through the inclusion of downstream small and medium-sized enterprises. While fully nested in One CGIAR 2030, the strategy remains unique in its design to respond to the challenges of rice-based agri-food systems in Africa. While fully aligned to national, regional and continental R4D strategies, it aims to contribute positively to achieving all the Sustainable Development Goals (SDGs), especially that of zero hunger (SDG 2).

The new strategy has sought ownership from all categories of rice stakeholders in Africa to ensure that collective responsibilities are fully understood, and all stakeholders are dedicated to the effective transformation of rice-based agri-food systems for a healthier Africa. A reformulated vision, mission and value proposition will guide the implementation of the new strategy. Moreover, the strategy is relatively flexible, as it responds to the rapidly changing external environment, presents the choices made by the stakeholders of AfricaRice, and translates these choices into action. It identifies existing obstacles and sets milestones for overcoming them.

Generating the necessary resources to fully implement the new strategy is one of the most critical issues to be addressed during its implementation. Two main resource mobilization approaches are envisaged: (i) One CGIAR funding through resources allocated from pooled funding to global and regional initiatives that will establish collaboration pathways with AfricaRice; and (ii) bilateral funding through resources allocated to specific projects that will allow AfricaRice to conduct R4D activities that build on relevant outputs and outcomes obtained from implementation of the previous strategy and complement flagship initiatives.

In effect, these initiatives are aligned with the core competencies of AfricaRice that have been developed over the years through engagement with various rice sector stakeholders in Africa and One CGIAR, supported by the Council of Ministers, the Board of

Trustees and AfricaRice management. A clear message that needs to be retained, however, is that the new strategy will always offer an open door to ensure full engagement and consultation with all stakeholders engaged in the rice sector in Africa. While AfricaRice is strongly convinced that research carried out to transform rice-based agri-food systems in Africa will deliver pragmatic options for African populations and the environment, it is very aware that this can only happen at the scale required to generate the desired impact if all hands, including those of our valued stakeholders, are on deck. Funds leveraged through, by and for the stakeholders of the rice sector will therefore be another important source of resources.

On behalf of the management and staff of AfricaRice, I would like to express my deep appreciation to everyone who contributed to the development and review of the 2030 Rice Research and Innovation Strategy for Africa. Your efforts have certainly enhanced the ability of stakeholders of the rice sector to provide relevant science-based solutions that will reduce rural poverty and ensure a healthier Africa.



**HAROLD ROY-MACAULEY**  
*Director General, AfricaRice*

African cultivated rice (*Oryza glaberrima*)





# EXECUTIVE SUMMARY

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## Vision

To sustainably improve food and nutrition security for a healthy and prosperous Africa.

## Mission

To deliver rice-based innovations and transformed rice-based agri-food systems that contribute to the transformation of food, land and water systems in the face of climate change.

## Value proposition

A single, fully integrated and coordinated Rice Research and Innovation Strategy for Africa will leverage science, partnerships and investments to deliver rice-based innovations and transformed rice-based agri-food systems that will offer the following specific values: (i) a sustainable increase in local production of high-quality consumer-preferred rice; (ii) generation of incomes especially for women and youth; (iii) increased resilience of rice-based agri-food systems; and (iv) improved nutritional status of malnourished people.

AfricaRice and its partners are the preferred providers of these values because of their excellence in rice research, proven capacity to engage with national and international partners, and ability to set new

rice research and innovation agendas. They can also build capacities along the rice value chain and support better decision-making to drive sustainable development in Africa due to having a strong political mandate from the Council of Ministers of AfricaRice.

## Impact

The impacts that will contribute to achieving the mission and vision are aligned with those of the One CGIAR 2030 Research and Innovation Strategy and can be grouped into five impact areas: (i) nutrition, health and food security; (ii) poverty reduction, livelihoods and jobs; (iii) gender equality, youth and inclusion; (iv) climate adaptation and mitigation; and (v) environmental health and biodiversity.

## Outcomes

- Integrated rice breeding and seed systems platform for more productive, nutritious and resilient varieties.
- Resilient and inclusive rice-based systems and nutrition-sensitive food value chains for sustainable diets, livelihoods and environments.
- Transformative policy environment to promote supporting policies, based on foresight and ex-ante analysis for scaling up rice innovations and impacts.

## Outputs

- Strengthened leadership in advocacy for use of local rice in Africa.
- Increased productivity and genetic gains in farmers' fields.
- Increased access for farmers to improved rice varieties and improved seed delivery channels.
- Increased adoption of climate-smart practices and digital climate and advisory services.
- Resilient rice-based systems and nutrition-sensitive food value chains.
- Policy options and institutional innovations.
- Empowered youth and women engaged in rice-based agri-food farming and entrepreneurship.

## Core research action areas

### *1. Improve the capacity and ability of research stakeholders in the rice sector to contribute to improving the performance of rice-based agri-food systems*

- Collect and conserve the indigenous rice diversity heritage available in Africa to avoid loss, and ensure data are available on the collections to facilitate the identification and use of genetic variation for rice improvement responding to cultural demands, consumer preferences and product profiles.
- Incorporate all rice-growing countries in a network focused on the evaluation of advanced breeding lines.

Rice panicles showing a diversity of color and form in the Rice Biodiversity Center for Africa



- Establish modern breeding technologies, such as rapid generation advancement and high-throughput phenotyping facilities, trait and gene discovery technologies, genomic selection and crop simulation models to shorten the breeding cycle, increase genetic gain and accelerate variety turnover for farmers.
- Achieve systematic sequencing of adapted rice germplasm to identify genomic regions associated with superior agronomic and consumer traits.
- Strengthen foresight capabilities, data sharing and analytics, machine learning and advanced statistical modeling to better forecast agricultural and demographic trends to inform the types of research that will best upgrade rice-based agri-food systems.

## ***2. Improve the socioeconomy of rice-based agri-food systems to stimulate the economy***

- Examine the barriers to behavioral change in rice-based agri-food systems and the distribution of costs and benefits using an inclusive social equity lens.
- Establish world-class monitoring, evaluation and learning, and ex-ante and ex-post impact assessment frameworks, to design and monitor equitable interventions that create inclusive prosperity, including the empowerment of women and youth and promotion of appropriate marketing channels.
- Facilitate the establishment of a strong public-private partnership network (supply push, market pull) of seed producers and millers to ensure access to quality seeds, and encourage and stimulate the growth of small- and medium-sized enterprises in the rice supply chain.
- Establish a focused and robust continental plan that makes the case for policies and investments

to reduce the chances of failure in rice investment decision-making and rice value chain upgrading and development in Africa.

## ***3. Acknowledge the links between rice production, food and health, and the delivery of appropriate nutritional outcomes***

- Enhance the diversification of rice-based agri-food systems to contribute to improvement of diets and the nutritional status of malnourished people, and forge stronger partnerships with global initiatives that focus on biofortification as an option for improved nutrition.
- Establish partnership networks, including creating and nurturing strategic alliances with other CGIAR centers based on demand-driven measures.

## ***4. Improve resource use efficiency and delivery of appropriate environmental outcomes***

- Create precision agronomy digital decision-support tools that draw from the best of the African context.
- Integrate surveillance-based, environmentally friendly and climate-smart approaches in plant health management.
- Improve production efficiencies through mechanization and small-scale irrigation to encompass rice-based production systems in lowland ecosystems.
- Significantly reduce losses by adapting and catalyzing the adoption of mechanized harvesting and improved postharvest threshing and milling management practices and storage technologies, such as solar bubble dryers and hermetically sealed storage systems.
- Sustainably increase rice cultivation in appropriate agro-ecosystems, particularly the underutilized inland valley ecosystems, with good governance in coordination with other land and water users.

## Enablers

The Rice Research and Innovation Strategy for Africa will adopt a results-focused holistic approach to research for development (R4D), advancing initiatives according to their ability to deliver outputs, outcomes and impacts on the ground.

Global and regional R4D project portfolios to drive the new research strategy for Africa will consist of robust impact pathways and agile monitoring, evaluation and learning capabilities that will close out avenues of research that do not contribute to One CGIAR Impact Areas and to the Sustainable Development Goals (SDGs).

A four-tiered monitoring, evaluation, learning and impact assessment (MELIA) framework will be established to facilitate: (i) impact of R4D projects that contribute directly to the One CGIAR Impact Areas; (ii) direct contributions to the One CGIAR Action Areas (Genetic innovation, Resilient agri-food systems and Systems transformation) by each investment initiative; (iii) the readiness of use of R4D innovations and the effectiveness of the dissemination and adoptability of insights from engaging countries; and (iv) impact at

scale by each investment initiative. This MELIA system will be flexible and will allow adjustment of the R4D program over time. It will also institutionalize country goals in line with national agricultural development plans. It will provide a barometer to measure progress, provide information to inform decision-making at critical junctures and highlight key success factors.

Based on progress made in an initial set of countries, over the medium to long term, a proof of concept will be designed for the transformation of rice-based agri-food systems that can be readily adapted to other countries' needs. By investing in effective MELIA capabilities, conducting impact assessments, and operating proactively in a set of initial countries with diverse needs and challenges, a diverse portfolio of rice-based R4D solutions capable of transforming rice-based agri-food systems will be developed and rolled out. The proof of concept will thus empower a wider group of stakeholders to drive progress toward a healthier Africa by 2030, in line with the One CGIAR Impact Areas (see section 3.5) and the SDGs.

Left: Lowland rice trials; Right: Recording growth data for the genebank



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# WHY A NEW RICE STRATEGY FOR AFRICA?

## 1.1. Growing importance of rice and urgency to develop competitive rice value chains



In sub-Saharan Africa (SSA), about 43% of the population, corresponding to 389 million out of a total population of 904 million, lives below the poverty line of US\$ 1.90 per day (World Bank, 2021). These people lack adequate safety nets guaranteeing sufficient food and other daily necessities. In the 2014 Malabo Declaration, African Heads of State and Government committed to ending hunger and halving poverty on the continent by 2025 through inclusive agricultural growth (African Union, 2014). This declaration supported the Comprehensive Africa Agriculture Development Programme (CAADP) adopted by African leaders in 2003, in which they formalized

their commitment to allocate at least 10% of total government expenditure to the agriculture sector within five years — a level of investment envisioned as essential to achieving an average 6% annual agricultural growth rate.

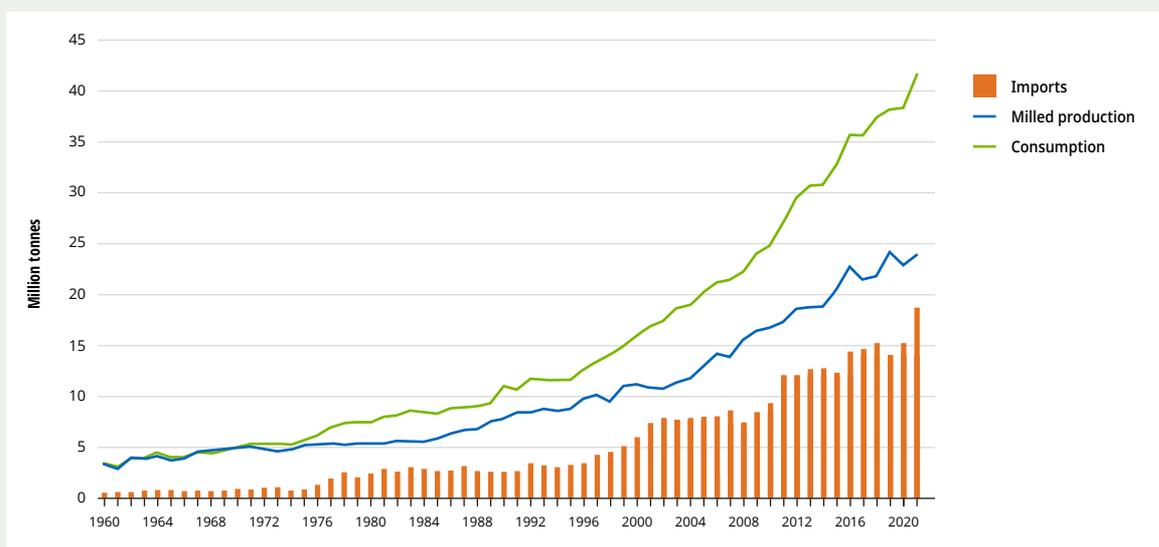
More than **20 million** African smallholder farmers produce rice, and more than **100 million** livelihoods depend on it

These policy and strategic frameworks consider rice in Africa as a strategic commodity for food security and nutrition, job creation (especially for youth and women) and poverty reduction. More than 20 million African smallholder farmers produce rice, and more than 100 million livelihoods depend on it. Productivity gains in rice have the highest impact on incomes, poverty and hunger, and rice is the second most important crop after wheat in fighting undernutrition in Africa (CGIAR, 2018). Rice consumption has increased rapidly from the 1960s, driven by the triple effect of demographic growth, rising per-capita consumption and urbanization. Consumption of rice is growing faster than that of any other staple food

crop in Africa. The annual per-capita rice consumption in Africa increased steadily from 10 kg in 1961 to 54 kg in 2017 (USDA, 2018) and is already more than 90 kg in countries such as Guinea, Guinea-Bissau, Liberia, Madagascar and Sierra Leone. By 2028, it is projected that Africa will have the second highest annual per-capita rice consumption in the world (after Asia) (OECD and FAO, 2019).

Africa's rice import bill, estimated at **US\$ 6 billion in 2020**, is expected to **double by 2030**

**FIGURE 1** PRODUCTION, IMPORTS AND CONSUMPTION OF MILLED RICE, AFRICA, 1960–2021



Despite increasing rice consumption and the huge potential for economic growth, domestic production meets only 55% of demand (Fig. 1). The gap is filled by imports mainly from Asia. Africa's rice import bill, estimated at US\$ 6 billion in 2020, is expected to double by 2030. There is, therefore, a major economic opportunity to increase local rice production since only 10 million out of 190 million hectares of suitable inland valleys are cultivated with rice. Africa's rice yields

are estimated to be about half of the world average and that could reduce further under the impacts of climate change, particularly with decreasing water availability and emerging plant health threats. Even if additional varieties adapted to such constraints were developed, delivering genetic gain to farmers' fields would be hampered by inefficient seed systems and weak links among value chain actors.

**FIGURE 2** CONTINENTAL RICE SELF-SUFFICIENCY LEVELS, AFRICA, 1960–2021



On the demand side, consumers consider a variety of rice traits, including aroma, taste, shape, size, softness and stickiness. Millers often determine the preferred rice varieties for a complex and fragmented market. In Africa, urbanization and the dominance of imported rice have increased the demand for high-quality, clean and homogeneous rice. Locally produced rice is supplied mainly through traditional value chains. These value chains proliferated after liberalization and a reduction in state control of industrial mills in the 1990s. They often comprise several intermediaries with small-scale capital and quantities of rice. Traditional millers purchase paddy through spot transactions, which do not include quality criteria and lack incentives for appropriate moisture levels, impurity rates and varietal homogeneity. As a result, traditional millers are often unable to supply the traits and purity desired by consumers. To increase the supply of domestic rice, therefore, local value chains must be enabled to compete with imports. This will require robust investment plans focusing

on postharvest infrastructure and quality upgrading along the value chain (Soullier et al., 2020).

Beyond these systemic challenges, socioeconomic and ecological imperatives, and the recent coronavirus disease 2019 (COVID-19) pandemic all complicate the task of producing sufficient rice and closing the demand gap (the extent of which is also illustrated by the continental self-sufficiency level, Fig. 2). Addressing the impacts of climate change will require mitigation of rice greenhouse gas (GHG) emissions, which are set to increase by 12% between 2017 and 2050 (van Loon et al., 2019). Driving sustainable intensification will help reduce the yield gap. Policy-makers will need to create enabling environments in which rice market actors drive inclusive economic growth and rural development, as well as providing incentives to preserve natural resources. Innovations and policies addressing the yield gap and sustainable production must therefore consider a wide range of imperatives and effectively address possible conflicting objectives.

Although rice-focused food security policies in Africa have led to a reduction in chronic hunger (undernutrition) over the past 30 years, Africa now needs to go beyond rice per se. There is a need to tackle hidden hunger (micronutrient deficiencies) and overnutrition (obesity and diabetes) by shifting the focus to food and nutrition security through safe and healthy rice-based diets. The current COVID-19 pandemic is a stark reminder that food systems remain precarious; therefore integrated and more diversified, resilient and healthy agri-food systems need to be developed (Arouna et al., 2020).

Yet, with rice increasingly providing the lion's share of the daily calorie intake in African diets, rice breeding should remain a major strategy and priority for national and international research partners engaged in accelerating genetic gains and simultaneously improving nutritional value. More than in past research endeavors, rice breeding now needs to be embedded in a more holistic and broader R4D strategy that builds on the work of national and international

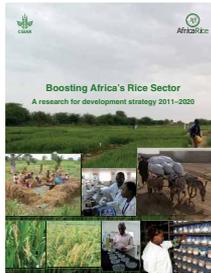
research centers as well as academic institutions. More focus needs to be put on addressing the weak links of diversified and safe nutrition-sensitive food value chains. This requires a strategic shift toward optimizing rice-based farming systems and developing rice-based diets to include vegetables, legumes and fish. It also includes bridging the "Missing Middle" (Veldhuizen et al., 2020) between production and consumption, and building on and taking stock of recent progress made by international R4D partners in biofortification and safe and improved nutrition. To create an enabling environment for private sector investment, safe and healthy nutrition-sensitive food value chains need to be created while also building capacities in effective business models to increase access to rice-based innovations.

These concerns call for the urgent transformation of the rice-based R4D approach through strong strategic and operational partnerships and alliances with other R4D partners at national, regional, continental and global levels.

Rice Biodiversity Center for Africa, M'bé station, Côte d'Ivoire



## 1.2. Orientations from the 2011–2020 strategy for boosting Africa’s rice sector



The 2011–2020 R4D strategy — *Boosting Africa's Rice Sector* — was developed against the backdrop of the Center's analysis of prevailing changes in the rice sector on the continent and globally. The strategy took into account the expected impacts of

climate change, population expansion, urbanization, the emergence of new and more dynamic agricultural markets in Africa, the long-term restructuring of the global rice market, and the potential for the rice sector to become a driver for economic development on the continent. The strategy centered around the following seven R4D priority areas.

1. Conserving rice genetic resources and providing smallholder farmers with climate-resilient and disease-resistant rice varieties that are better adapted to production environments and consumer preferences.
2. Improving rural livelihoods by closing yield gaps and promoting sustainable intensification and diversification of rice-based systems.
3. Achieving socially acceptable expansion of rice-producing areas while addressing environmental concerns.
4. Creating market opportunities for smallholder farmers and processors by improving the quality and competitiveness of locally produced rice and rice products.
5. Facilitating the development of the rice value chain (RVC) through improved technology targeting and evidence-based policy-making.
6. Mobilizing co-investments and linking with development partners and the private sector to stimulate uptake of rice knowledge and technologies.

7. Strengthening the capacities of national rice research and extension agents and RVC actors.

After 10 years of implementing this strategy, AfricaRice analyzed the relevance, effectiveness, efficiency and durability of the strategy, with a focus on the seven priority areas. The review highlighted factors that may have hampered effective action and examined issues surrounding the competitiveness of rice produced locally and the effectiveness of existing RVCs. It also informed the development of the new strategy, particularly regarding: (i) how public and private sector agents and smallholder farmers can access improved rice varieties and associated inputs to secure sustainable yield increases; (ii) how to improve the quality of the outputs and durability of the outcomes; and (iii) how to support actions that will spur economic growth through national and regional policy frameworks.

New Rice for Africa, a very successful family of rice varieties developed by AfricaRice through interspecific hybridization (*Oryza sativa* × *O. glaberrima*) in the 1990s and 2000s (NERICA 11)



### 1.3. Addressing pervasive and emerging challenges in rice-based agri-food systems

Africa is relatively well endowed with arable land, water resources, labor, technology and multistakeholder innovations developed through local, regional and international R4D partners. These provide conditions to increase the efficiency and effectiveness of rice production within rice-based agri-food systems. Several variables, however, prevent the continent from reaching its full potential to be self-sufficient in rice production. Climate change is arguably the most serious factor threatening long-term food and nutrition security and may require dramatic changes in African farming systems and practices. With changing climatic conditions and increasing urbanization, rice-based food production systems are at risk of becoming highly vulnerable to the vagaries of climate. A new rice R4D strategy for Africa would need to focus on building capacities to increase resilience and on reducing climatic risks in smallholder systems by scaling up inclusive climate-smart agricultural practices and simultaneously innovating production and postharvest management practices through mechanization and irrigation. It would need to work

with national and regional partners to innovate processes of change, and introduce, test and roll out innovative technologies bundled with accessible and gender-targeted digital climate, agriculture and nutrition advice, as well as finance and agronomic inputs, building on and complementing public and private sector schemes and partnerships, to reach millions of farmers and value chain actors.

Genetic gain realized in farmers' fields through higher turnover of high-yielding climate-smart rice varieties is not sufficient for local production to meet demand, especially under strictly rainfed conditions. Even if

Even if average productivity increased by 3% and cultivation area by 5% per year, it would require about **20 years** to produce sufficient rice to feed local populations

Drought is becoming increasingly prevalent in some rice-growing areas, including in inland valleys



average productivity increased by 3% and cultivation area by 5% per year, it would require about 20 years to produce sufficient rice to feed local populations, assuming climatic conditions do not deteriorate further. River basins, watersheds and inland valleys offer great potential to increase productivity and expand production into socially accepted underutilized areas. Realizing this potential, however, would require a more holistic and integrated approach, building on the germplasm collection in the custody of AfricaRice and its partners, which is rich in African rice (*Oryza glaberrima*) accessions.

The long-term negative impacts of climate change and the more immediate impact of COVID-19 should also be recognized. The COVID-19 pandemic exposed the vulnerability of existing single-commodity-based food systems and value chains, both in Africa and globally. Focusing on a single-commodity-based solution and a single crop approach is a risky response to the increasing demand for food and it fails to address the need for more diversified diets to improve nutrition and health.

The One Health approach that recognizes the interconnectedness between people, animals, crops and the environment provides a framework for addressing potential complex health challenges in rice-based agri-food systems. In effect, changes in the climate (increases in temperature, more frequent flooding, etc.) are making rice farming communities that are dependent on inland valleys in Africa more vulnerable to diseases such as malaria, which is transmitted by mosquitoes, and schistosomiasis (bilharzia), which comes from parasitic worms. A joint study on links between rice production and malaria in Africa by scientists from AfricaRice and the London School of Hygiene and Tropical Medicine (Chan et al., 2021) revealed that, since 2003, communities that grow rice have over 70% more malaria infections than non-rice growing communities. The study indicates the urgent need for health researchers



Trials to determine breeding success of malaria-vector mosquitoes at AfricaRice

and agriculturalists to work together to address this challenge.

There is enormous potential to boost the rice sector in Africa by increasing production

Despite current challenging times, there is enormous potential to boost the rice sector in Africa by increasing production (Wopereis et al., 2013). Specifically, river basins and inland valleys offer great potential to increase productivity and sustainably expand production into socially acceptable underutilized areas. Sustainable increases in productivity through growing adapted and improved rice varieties will boost food security and support a healthy environment and more secure livelihoods. With the population of Africa growing at more than 2% per year, and increasing urbanization, there is an urgent need to increase production, improve and diversify diets, provide opportunities for generating higher incomes, and create more jobs, particularly for youth and women living in rural areas.

## 1.4. One CGIAR creates an opportunity and confers a new role on AfricaRice



CGIAR is becoming a key player in the transformation of global food systems. An ambitious One CGIAR strategy is providing an opportunity to accelerate the achievement of systems resilience. Being part of a global R4D approach will be more cost-effective and has potential to generate additional support for AfricaRice, especially through mobilizing global solutions to adapt to local issues. It will provide the opportunity to shape a stronger and more relevant science agenda for today's dynamic world, with AfricaRice becoming a broker and builder of partnerships between national agricultural research, extension and education systems (NARES) and the private sector. It would also help exploit biodiversity in rice and enhance access to a global pool of genetic resources beyond the accessions held in the AfricaRice genebank. This would further the broad- and large-scale testing and use of innovations, including new production and postharvest technologies, and modern breeding and digital tools. It would also facilitate access to research and capacity-building expertise, building knowledge and sharing experiences within One CGIAR. It would spur strong South-South cooperation through alignment with existing national development strategies and those developed or in the process of being developed by African entities such as the African Union and the Forum for Agricultural Research in Africa (FARA) and regional entities such as the East African Community (EAC), Economic Community of West African States (ECOWAS), West and Central Africa Council for

Agricultural Research and Development (CORAF), Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) and the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA). This would help to promote ownership of AfricaRice by its constituencies, mobilize resources, and broaden implementation and delivery capacities.

In joining One CGIAR, AfricaRice is aligning with the CGIAR governance and management framework, and strengthening its capacity to serve its clients, such as institutions of the public sector, private sector and civil society. This is expected to narrow the gap between supply and demand and consequently reduce countries' export dependencies. On behalf of its member countries and with strong legitimacy from its Council of Ministers, AfricaRice will harness R4D efforts across the continent and leverage additional financial resources and technical expertise to bolster the transformation of rice-based systems on the continent.

One CGIAR will allow AfricaRice to modernize its approach and improve the delivery of new technologies. While the new strategy is to be implemented by national and regional partners, the African Union considers AfricaRice as the center of excellence for rice-based R4D research. AfricaRice will therefore take the lead in setting priorities for rice development across the continent and harness additional bilateral investment.



# DELIVERABLES OF THE NEW STRATEGY

The 2030 Rice Research and Innovation Strategy for Africa will guide action toward transforming rice-based agri-food systems to improve nutrition, health and food security, while also spurring economic growth. The strategy aims to build capacities to adapt to and mitigate climate change and maintain environmental health. As an R4D center of excellence, AfricaRice will build on its expertise in rice seed conservation and use, and work with its national, regional and international partners to promote innovative rice breeding programs, crop management practices and seed systems. It will facilitate strong public-private partnerships (PPPs) and build capacities to support the development and implementation of effective business models and thriving markets. AfricaRice has the credibility and capability to strengthen and broker relationships among a broad range of stakeholders, which will be a key route to success in ensuring that the transformation agenda delivers desired impacts. As part of One CGIAR, AfricaRice will be able to attract additional financial and technical resources, which will assist member countries to achieve their goals. Key stakeholders will include the regional economic communities and their technical arms, government ministries, private sector entrepreneurs, civil society, extension services and farmer cooperatives.

AfricaRice has the credibility and capability to strengthen and broker relationships among a broad range of stakeholders, which will be a key route to success

Nutritious rice-based diets can be key for the health of young children



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## 2.1. Vision and mission

The vision is to sustainably improve food and nutrition security for a healthy and prosperous Africa.

The mission is to deliver rice-based innovations and transformed rice-based agri-food systems that contribute to the transformation of food, land and water systems in the face of climate change, through leveraging science, partnerships and investments for a healthy and prosperous Africa.

## 2.2. Value proposition

A single, fully integrated and coordinated Rice Research and Innovation Strategy for Africa will leverage science, partnerships and investments to deliver rice-based innovations and transformed rice-based agri-food systems in Africa that improve food and nutrition security while also increasing incomes, acknowledging the links between rice production and supply, food and health, and the need to support healthy and diversified diets.

These transformed rice-based agri-food systems addressing the challenges of food, land and water systems in the face of climate change will offer specific values:

1. a sustainable increase in local production of high-quality consumer-preferred rice;
2. generation of incomes especially for women and youth;
3. increased resilience of rice-based agri-food systems; and
4. improved nutritional status of malnourished people.

Genebank operations include many field activities, from characterization, through multiplication to rejuvenation

AfricaRice and its partners are the preferred providers of these values because of their excellence in rice research, proven capacity to engage with national and international partners, and ability to set new rice research and innovation agendas. They can also build capacities along the rice value chain (RVC) and support better decision-making to drive sustainable development in Africa because they have a strong political mandate from the Council of Ministers of AfricaRice.

### 2.3. Specific objectives

- Significantly enhance average rice yields in Africa (currently around 2 tonnes/ha in fully irrigated environments) with market-oriented high-yielding varieties together with associated good agricultural practices (GAP) and sustain 3% annual growth in rice production to narrow the supply–demand gap by 2030.
- Double rice-producing farmers’ incomes by 2030 by increasing rice yields and strengthening inclusive rice-based agri-food markets, thus promoting resilient, equitable and prosperous livelihoods.
- Narrow the supply–demand gap and reduce reliance on rice imports — this will help to increase Africa’s food self-sufficiency and make the continent more resilient in the face of future food crises and pandemics.
- Safeguard rice biodiversity (which is vulnerable to climate change) by collecting and storing valuable germplasm, working in close collaboration with all AfricaRice member countries.
- Improve nutrition by promoting biofortified, nutrient-enriched rice varieties, and diversified rice-based diets, to tackle the triple burden of undernutrition, overnutrition and micronutrient deficiency by 2030.
- Modernize breeding practices as part of a global rice-breeding alliance, which integrates NARES and has the key purpose of accelerating the deployment of preferred varieties with increased genetic gain.
- Improve access to climate-smart rice varieties to diversify food production systems and build the required operational and institutional mechanisms for strong seed systems.
- Build resilience and reduce climatic risk in smallholder systems by scaling up inclusive climate-smart agricultural practices and technologies. These will be combined with delivery of accessible and gender-targeted climate, agriculture and nutrition advice; access to financial and agronomic inputs; and facilitation of PPPs across the RVC.
- Build capacity and facilitate resource mobilization to increase investment in rice-based systems, particularly irrigated production systems and postharvest mechanization to reduce drudgery and make farming attractive to youth.
- Mitigate the contribution of rice-based production systems to climate change by encouraging African governments to include rice carbon emissions in their Nationally Determined Contributions, expanding climate-smart crop management practices to cover at least 75% of the rice-growing area by 2030, reducing the CO<sub>2</sub>-equivalent of rice production by at least 10% between 2020 and 2030, and increasing water and other resource use efficiencies by at least 10% over the same period.
- Strengthen the capacity of youth and women to participate equally in rice-based economies and promote gender equity among the principal partners (including NARES, the private sector, farmer organizations, food processors and traders) through increased training opportunities (50% increase in training volume by 2030).

## 2.4. Theory of change and intervention domains

Specific activities will be grouped into seven intervention domains.

- **Develop an integrated rice breeding platform** to increase genetic gains in farmers' fields and boost productivity.
- **Facilitate PPPs to build resilient seed systems** delivering quality rice to enhance marketing channels and increase rice supply.
- **Diversify and modernize rice-based agri-food systems**, reducing production costs and improving product quality to increase competitiveness in local and regional markets, and develop nutrition-sensitive food value chains to provide improved diets. This includes disseminating biofortified rice, particularly to consumers in rural areas where there are relatively few options for diversified diets.
- **Pursue inclusive landscape management**, including the identification and management of plant health threats, to reduce the vulnerability of rice-based agri-food systems to shocks and increase resilience.
- **Professionalize rice-based agri-food systems**, building on digital tools for responding to human and environmental health to increase resilience.
- **Build capacity in entrepreneurship for youth and women** to facilitate their full engagement in rice-based agri-food systems.
- **Develop best-fit investment plans, policy measures, and technical and institutional innovations** (e.g. digital tools and small agricultural machinery) to increase value for money of investments in rice systems and provide an enabling environment for private sector investment in the sustainable development and upgrading of RVCs in Africa.

Red rice, a local favorite, on sale at a market in Madagascar



These intervention domains aim to address the most urgent challenges, which include climate change and its ever-increasing impact on rice-based agri-food systems; an unsustainable reliance on relatively cheap imported rice (despite huge production potential in SSA) and the impact of this on incomes and economic growth; the poor quality of diets in general and the potential of diversified rice-based foods to improve nutrition; overall low productivity, large postharvest losses and issues relating to the inadequate capacity of stakeholders and low technology adoption.

The seven intervention domains will produce the following major outputs.

- Leadership in conservation, advocacy and use of indigenous rice in Africa.
- Increased genetic gain due to rapid turnover of new rice varieties in farmers' fields.
- Increased rice supply, based on improved varieties and seed delivery channels enabled by the private sector.
- Adoption of climate-smart practices and digital climate and advisory services including diagnostic, surveillance and integrated pest and disease management innovations.
- Establishment of rice-based systems and nutrition-sensitive food value chains responding to human nutrition and environmental health, through an effective inland valley rice program.
- Policy options and institutional innovations to encourage private sector investment and scale up rice-based investments and evaluation to landscape level.
- Empowerment and improved knowledge among youth and women, promoting their engagement in rice-based agri-food farming and entrepreneurship.

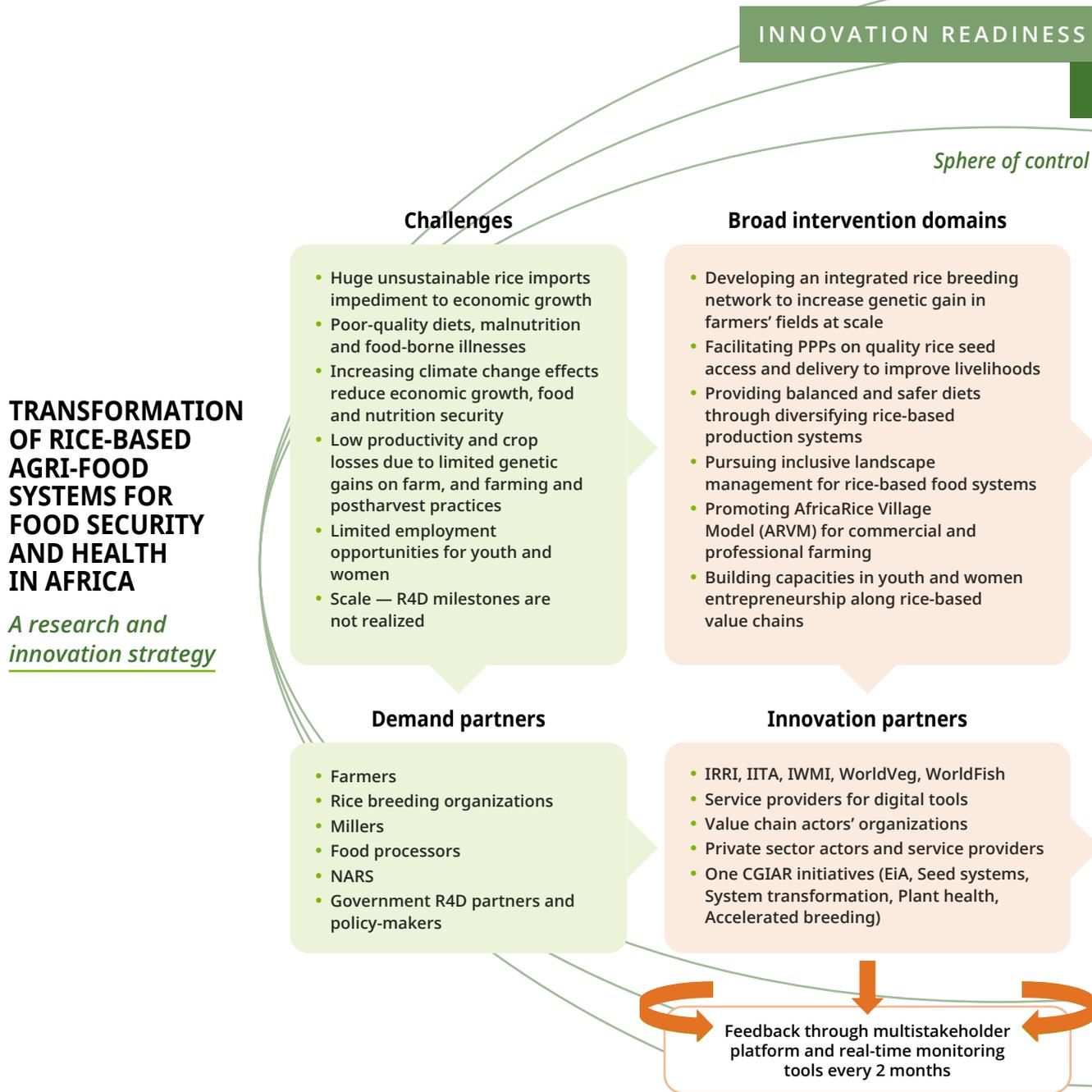
Over the longer term (10 years) and beyond the direct sphere of influence of AfricaRice, strong contributions will be made to the **five One CGIAR Impact Areas** (nutrition, health and food security; poverty reduction, livelihoods and jobs; gender equality, youth and inclusion; climate adaptation and mitigation; and environmental health and biodiversity) and to the Sustainable Development Goals (SDGs).

To deliver these results and outcomes, all stakeholders will need to forge and strengthen a broad range of partnerships at national and regional levels and catalyze investment in the rice sector.

Figure 3 illustrates the theory of change.



**FIGURE 3** OVERVIEW OF THE THEORY OF CHANGE



COSEM-Riz, Consortium of Rice Seed Enterprises and Millers; EiA, Excellence in Agronomy; IITA, International Institute of Tropical Agriculture; IRRI, International Rice Research Institute; PPP, public—private partnership; R4D, research for development.

## INNOVATION USE

## AT SCALE

### Sphere of influence

#### Outputs

- On-farm genetic gain increased by improved access to quality seed
- Strong and sustainable PPP for seed development and milling that builds markets for locally produced rice
- Climate-smart practices and digital climate and advisory services adopted
- Effective inland valley rice platforms (IVRPs) for improved human and environmental health
- Innovative policies that guide scaling, rice-based investments and evaluation at landscape level
- Youth and gendered business opportunities to increase youth and women's entrepreneurship

#### Scaling partners

- One CGIAR
- Development partners
- NGOs
- Donor-funded projects
- COSEM-Riz

### Sphere of interest

#### Outcomes

- Transformed, inclusive rice-based systems are sustainable and able to substitute imports, improve adaptation to climate change, and provide balanced and safer diets
- AfricaRice integrated breeding and seed systems platform fully integrated with other rice breeding and seed systems, while PPPs ensure effective uptake of quality seed by stakeholders
- A transformative policy environment that enables adoption of rice-based innovations at scale, thriving entrepreneurship, and increased employment for youth and women

#### Demand partners

- Farmer and processor organizations
- Food processing companies
- NARS
- Government R4D partners and policy-makers

#### Impact areas



Nutrition, health and food security



Poverty reduction, livelihoods and jobs



Gender equality, youth and social inclusion



Climate adaptation and mitigation



Environmental health and biodiversity

SUSTAINABLE DEVELOPMENT GOALS

2025

2030

## 2.5. Outcomes

### *Integrated rice breeding and seed systems platform*

For effective adaptation to climate change and gains in food and nutrition security, farmers need access to improved rice varieties that are more productive, nutritious and resilient than those grown currently. This requires an integrated breeding program to bring together CGIAR centers and NARES partners in the same breeding network. Genetic gains should be measured in terms of multiple demand-led traits. These include climate resilience (e.g. drought or heat tolerance, pest and disease resistance), nutritional value (e.g. biofortification) and market traits valued by millers and consumers (e.g. improved shelf life,

taste or cooking time). Strategic market segmentation and product profiling will be conducted to ensure that new varieties can compete against imports in coastal markets (which have the cheapest and easiest access to imported rice) and fully embrace African rice cultural heritage and genetic diversity.

AfricaRice's greatest asset of global significance is its Rice Biodiversity Center for Africa (RBCA), an ultramodern infrastructure located in Bouaké, Côte d'Ivoire. The Center holds the largest rice germplasm collection in Africa, with almost 22,000 accessions, and the largest collection of the African cultivated rice species (*O. glaberrima*) in the world, as well as the wild species *O. barthii* and *O. longistaminata*. The facility has the capacity to conserve up to 60,000 rice accessions under optimal conditions. The rice genetic resources housed in RBCA are the key to developing new varieties that are adapted to climate change in African agro-ecosystems. RBCA will contribute to increasing the productivity and profitability of the rice sector in Africa by conserving, securing, analyzing and

AfricaRice's greatest asset of global significance is its Rice Biodiversity Center for Africa, which holds the largest rice germplasm collection in Africa

Genebank operations



developing the unique rice genetic diversity available in SSA, breeding high-yielding, climate-resilient varieties with preferred end-use quality traits.

RBCA will take the lead in: (i) managing routine genebank operations in accordance with the CGIAR performance targets on germplasm availability and distribution, safety backup, passport data completeness index and quality management system; (ii) conducting scientific studies on gene discovery using rice genetic resources and donor identification to promote germplasm use; (iii) serving as a showcase for and raising public awareness on rice biodiversity; (iv) sharing resources, knowledge and expertise with national genebanks in Africa to advance scientific research on the continent; and (v) promoting the collection and conservation of rice biodiversity in Africa.

The AfricaRice seed system development program has already contributed to the dissemination of promising varieties. The entry point is in the production of breeder seed of improved new mega rice varieties and hybrids.<sup>2</sup> AfricaRice is mandated by member countries to produce high-quality breeder seed, using its stations in M'bé (Bouaké) in Côte d'Ivoire and Saint-Louis in Senegal as core breeder seed production and delivery platforms. The AfricaRice Nigeria and Madagascar stations, and sites in other countries, are used as satellite breeder seed production platforms to ease logistics in the production and delivery of seed. Breeder seed is supplied to small private enterprises as the basis for the foundation

Top: A diversity of seed maintained in the genebank.  
Middle: Genebank staff.  
Bottom: Early stage characterization of accessions.

<sup>2</sup> Foundation and certified seed production is the mandate of national partners including private seed enterprises. AfricaRice may provide expertise in the development of foundation seed of improved rice varieties including those requested specifically by countries and/or the private sector.





Proprietors of seed enterprises from Burkina Faso and Mali in discussion at a COSEM-Riz event

and certified seed that is shared with smallholders and commercial farms through a PPP arrangement. A coordinated seed supply chain is being developed through the Consortium of Rice Seed Producers and Millers (COSEM-Riz), a (potentially) pan-African consortium of public and private sector agents, which will distribute breeder seed. COSEM-Riz will respond to seed demands from national governments, non-governmental organizations (NGOs) and private sector operators. It will produce foundation and certified seed, with technical and quality oversight support from AfricaRice and national seed regulatory agencies. Seed enterprises and millers will then distribute the seed through contractual arrangements with farmers. These RVC actors are an essential part of the public and private sector pathways that will increase the scale of dissemination and use of the improved rice varieties.

The new strategy will prioritize lowland rice ecosystems, where the necessary increases in productivity will be most rapidly attained

### *Resilient and inclusive rice-based systems and nutrition-sensitive food value chains*

This outcome relates to the improved sustainability of diets, livelihoods and the environment. Adaptation to climate change and mitigation of GHG effects, including plant health threats, will be central to all initiatives. Innovations will be delivered at field, farm, community and landscape levels. The water-food-energy nexus is a fundamental part of sustainable development. Demand for all three is increasing, driven by a rising global population, rapid urbanization, changing diets and economic growth. Agriculture is the largest consumer of the

Diversified cropping system in an inland valley



world's freshwater resources, and more than one quarter of the energy used globally is expended on food production and supply (UN Water, no date). The inextricable linkages between these critical domains require a suitably integrated approach to ensuring water and food security, and sustainable agriculture.

The new strategy will prioritize lowland rice ecosystems, where the necessary increases in productivity will be most rapidly attained. Research on effective water management and suitable cropping calendars will seek to maintain sustainable yield increases in the face of climate change. It will also address the need for dietary diversification, income generation and soil management through intercropping and crop rotation with other commodities, including roots, tubers, vegetables, bananas and cocoa, depending on the region, with fish farming providing an additional livelihood strategy. Rice-based systems will become better connected with markets by developing inclusive and nutrition-sensitive value chains.

### *A transformative policy environment*

AfricaRice will work with regional and national partners to develop new policy options and institutional innovations to ensure the products of rice-based agri-food systems are sustainable and competitive. This includes using its convening power to work with governments and private sector agents, inside and outside the rice sector, to invest in the RVC (including postharvest aspects), promote sustainable increases in rice production, and spur economic growth through developing aligned businesses. The main goals will be to catalyze demand and develop innovative supply interventions throughout rice-based agri-food systems.

A transformative policy environment relies on the engagement of policy-makers from the beginning (scoping stage) of designing new technologies and institutions, which should be framed within local contexts, driven by demand and provide holistic solutions to the most pressing problems. The strategy

Training is key to capacity-building for outscaling new technologies and practices: Smart-valleys





seeks to promote supporting policies, such as the use of digital tools, precision agriculture and agro-ecological approaches to protect land and water resources. These will be formulated and endorsed by local governments and partners, and backed up with institutional empowerment and property rights for proper enforcement. Efforts to transform the policy environment will also consider young research programs and work to strengthen the capacities of relevant rice-based transformation systems, such as genebanks, seed systems, postharvest management and mechanization. Efforts will also be made to build capacity within national universities to improve the skills of the youth (especially women) to engage in small- and medium-sized enterprises (SMEs).

Formulation of and recommendations for new policies will be based on foresight, ex-ante analysis, scientific evidence and local socioeconomic contexts to create conducive environments for scaling up rice innovations and their impacts. The new strategy includes further actions to ensure the effective functioning of a continent-wide network with rapid adoption of superior varieties. This will be achieved by identifying the key needs and designing a plan for human and infrastructural capacity development. It will be supported by new and appropriate investment plans at local, national and regional levels to attract large-scale public and private sector finance to the rice sector across Africa. Advanced market and consumer profile analysis will help to identify opportunities for market segmentation to aid investment decisions and increase access to finance.

GEM rice parboiler training



# CROSS-CUTTING ISSUES AND SYNERGISTIC EFFECTS

## 3.1. Gender equality and social inclusion

Women often lack equal access to land, technology, credit and extension services. They also lack full participation in decision-making processes and often fail to benefit from the proceeds of business decisions (FAO and CARE, 2019). The youth have huge potential to drive economic growth and development, but they are disproportionately affected by rural-to-urban migration and unemployment. Many young people are unwilling to consider a career in agriculture because of non-conducive production and marketing environments. The new AfricaRice strategy is based on a gender equality approach, which is fully embedded in the One CGIAR Impact Area Gender equality, youth and inclusion. Projects and programs will therefore seek to mainstream the engagement of youth and women in R4D efforts. This will include creating opportunities for building capacities through regional and international training centers and participating in technology generation by developing, testing, adapting, verifying and promoting business models to optimize gains from rice-based agri-food innovations. Interventions will also aim to improve access to credit and create employment opportunities, particularly through the development of SMEs.



Women and youth will be considered as equal partners and provided with equal opportunities to engage fully in value chain activities and to enjoy the benefits

The strategy aims to increase the engagement of youth in agriculture through disseminating innovative technologies and business opportunities, and to boost women's leadership and decision-making within their households and communities. Particular attention will be paid to addressing the challenge of women's traditional roles, to reduce their burden of care and allow them to work more productively. Such interventions will enhance the social and economic empowerment of women and youth, and raise their incomes. AfricaRice will use its existing partnerships to build support for gender equality, youth and inclusion, and influence policy-makers at national and regional levels to ensure that future initiatives along the RVC include these issues. Women and youth will be considered as equal partners and provided with equal opportunities to engage fully in value chain activities and to enjoy the benefits. Encouraging the development of diversified rice-based systems and

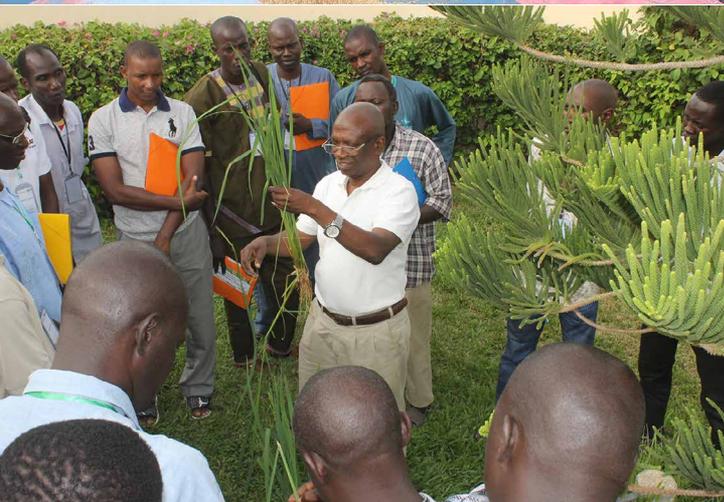
nutrition-sensitive food value chains will generate new on-farm and off-farm income opportunities for women and youth, improving equality and social inclusion.

### 3.2. Building capacities

Capacity-building is an important strand running through the new strategy. Actions will include conducting a thorough initial analysis to identify the major gaps and suitable entry points for engagement with key stakeholders.

While AfricaRice already conducts capacity-building programs, the design of future programs will be matched more closely with partners' needs. Activities will include technical training for NARES to enable them to better generate and deliver rice-based technologies and innovations. Engagement of stakeholders in the RVC will be increased by providing knowledge and tools to women and youth, and upstream and downstream R4D stakeholders (including national and regional policy organizations, national development agencies and scaling partners such as extension services, NGOs and the private sector). There will be a specific focus on changing attitudes and mindsets through training in leadership, building a favorable organizational culture and creating a conducive environment for system transformation. Internships involving undergraduates and doctoral students working in collaboration with universities and technical training institutes will be another key approach. These will enable national and regional partners to conduct quality research and build their capacity to produce policy instruments such as national development plans and strategies.

Downstream R4D stakeholders (local NGOs, civil society and farmer organizations, and SMEs) also require specific training to increase their engagement with upstream partners (e.g. One CGIAR, advanced research institutes, regional universities and specialized training centers). This training will address technical and organizational weaknesses. Rice producers will also be encouraged to share their knowledge and experiences through training-of-trainers courses and practical training sessions targeting community-based facilitators and champions of change, including local government policy-makers and vulnerable groups of women and youth.



Capacity-building: good small-scale winnowing (top) and plant identification (bottom)

## CREATING OPPORTUNITIES FOR WOMEN AND YOUTH

In 2015, with support from the Government of Senegal, the African Development Bank and West African Economic and Monetary Union, AfricaRice established a special platform dedicated to the professionalization of actors along the RVC, with a special focus on women and youth. Within this facility, AfricaRice aims to train a new generation of hands-on rice experts and entrepreneurs through seasonal training in rice management and entrepreneurship. The training center in Saint-Louis, Senegal offers short technical courses (one to three weeks) for stakeholders including value chain actors, national researchers, extension agents and development personnel. AfricaRice will continue to build on this asset and, based on assessment of the impact of the training program, will increase the scale of activities to provide more opportunities for women and youth. The successful approach exemplified below will be continued under the new strategy.

**Training for youth entrepreneurship and job creation in the rice value chain at the AfricaRice Training Center:** As part of a project to promote youth entrepreneurship and job creation in West Africa's RVC, implemented in collaboration with the Technical Centre for Agricultural and Rural Cooperation (CTA) and the Syngenta Foundation for Sustainable Agriculture from 2018 to 2020, some 310 young people from Mali and Senegal were sensitized on business opportunities in the RVC and about 215 of them were trained in entrepreneurship and technical skills, and information and communications technology (ICT) for agribusiness. Among these were 126 representatives of youth groups who reported back and passed on the training materials, reaching an additional 8666 youth. An impact assessment conducted in May 2020 confirmed increased yields and increased income (AfricaRice, 2021). Project beneficiary producers increased their rice area by

an average of 0.9 ha and their yields by 1.96 tonnes/ha compared with non-beneficiaries; and achieved an average gross income from rice of €EU 456 per hectare in the dry season — the project helped them triple returns on their investments. Overall, more than 2800 youths increased their incomes through the project. In terms of employment, each of the 78 enterprises established by beneficiaries of the project's competitive grants and finance through agricultural development banks created an average of over five jobs — that is 456 young people helped into employment by the project. The success of this project led to the launch of a youth-focused COVID-19 response intervention in Senegal in 2021 with support from Mastercard. The initiative will build the capacity of 5300 beneficiaries — consisting of farmers, rice millers, traders and service providers — 1300 direct beneficiaries and 4000 indirect beneficiaries. In addition, 3000 jobs will be created, especially for young people and women, and 15,000 rice-growing households in the Senegal River valley will be reached.

Training of farmers on new agronomic practices in the rice field



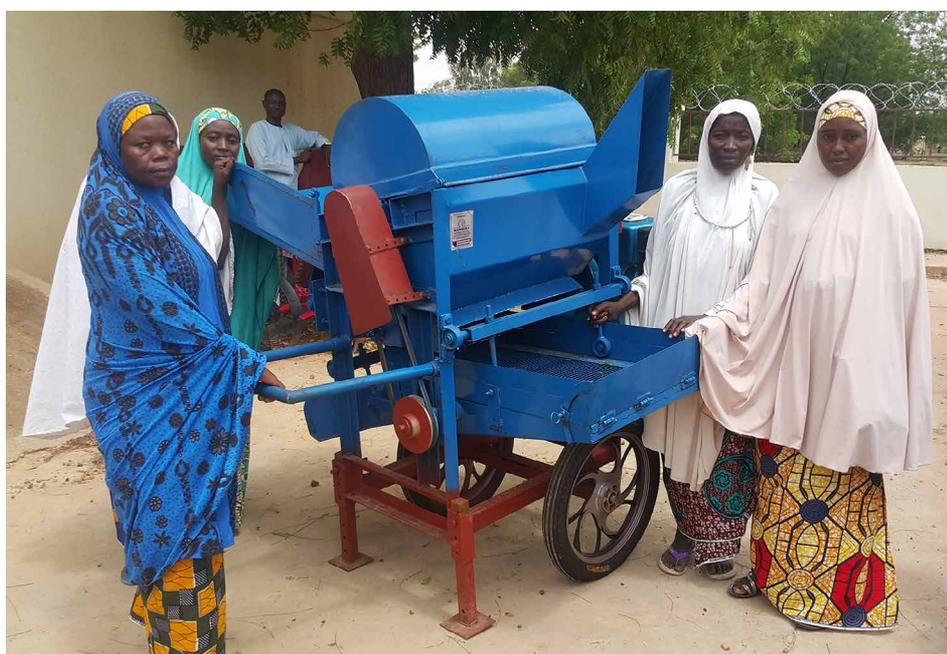
### 3.3. Public-private partnerships

Partnerships are the key to successful generation and scaling up of technologies and innovations since no single organization has the capacity to turn research into impact on its own. Partnerships can provide mutually beneficial long-term cooperation and peer relationships focused on enhancing livelihoods. AfricaRice has been building partnerships with member countries since its genesis. To help NARES and governments conduct research for impact, AfricaRice scientists consult closely with their research partners, who often play a catalytic role in forging links with the private sector. AfricaRice also continues to adapt its R4D strategy to the needs and requests of specific countries to ensure individual needs are met.

AfricaRice instituted and continues to facilitate Africa-wide Rice Task Forces. These encompass rice breeding, mechanization, agronomy, processing

and value addition, policy and gender issues. They comprise NARES scientists and/or entrepreneurs and AfricaRice scientists. They develop appropriate technologies and innovations and strengthen the capacity of RVC stakeholders by generating multiple benefits related to specific impact areas (as defined in the new strategy and by One CGIAR). They have the potential to build multi-disciplinary partnerships with other members of the R4D community. Through their upstream (policy-makers) and downstream (farmers, NGOs, etc.) actions, the task forces represent partnership models that contribute to the overall One CGIAR strategy. The task force network will continue to engage with African regional and sub-regional organizations, technical institutions, farmer organizations and agricultural universities to generate and package knowledge products that will inform policy decisions.

Left: AfricaRice 'AST' thresher-cleaner; Right: Discussion with young agri-entrepreneur rice seller



To deliver innovation at a large scale, AfricaRice has also established multistakeholder ‘innovation platforms’ and ‘rice sector development hubs’ (rice hubs) at country level. AfricaRice created the innovation platforms to improve the commercial aspects of farming and bring relevant public and private sector actors together. The platforms identify production and market opportunities and challenges at every level in the RVC, including organizational and institutional innovations (e.g. contractual arrangements, quality assurance and regulations, packaging and branding); technologies (e.g. improved and climate-smart varieties and hybrids, quality seed, agronomic practices, parboiling and milling); collective action, learning and knowledge-sharing; and policy processes through dialogue and influence at local, national and regional levels.

The rice hubs were established in 2012 and represent key rice-growing environments and market opportunities across Africa. They are linked with major national, regional and global rice development efforts to facilitate broad uptake of rice knowledge, technologies and innovations, and promote the sharing of information and knowledge. Documentation on scalable technologies that have already been developed and tested in an African context and proven successful can be accessed online through the rice hub website ([www.ricehub.org](http://www.ricehub.org)). National partners can also upload information to the site.

Innovation platforms provide an institutional vehicle to deliver transformation and impact, while the rice hubs provide technical pathways to increase the scale of rice-based agri-food systems across Africa. Innovation platforms illustrate how diverse socioeconomic operators can work together to achieve positive change and development. Both vehicles will be continued through the new strategy, as AfricaRice aims to establish strong multistakeholder mechanisms for improving livelihoods and promoting economic development that are fully embedded in national development programs.

Access to quality agro-inputs such as seeds of improved and climate-smart varieties, including hybrids, and supporting services (e.g. electronic registration and digital tools, mechanization and good agronomic practices, processing and value addition, packing and branding, regulatory frameworks and policies), is a necessary precondition for the successful transformation of rice-based agri-food systems. PPPs with regulatory agencies, seed enterprises and millers provide entry points for catalyzing the production and delivery of quality rice seed. PPPs are also a valuable aid to improve access to high-value markets for quality domestic parboiled and non-parboiled milled rice.

‘ASI’ thresher–cleaner in action



### 3.4. Digitized knowledge management for effective scaling of technologies and innovations

Technological advances are sweeping across Africa and increasing numbers of organizations, including farmers, rely on information technology to provide real-time information and knowledge in digital formats

The new strategy will make extensive use of ICT to facilitate exchange of information and knowledge, ensuring improved access of stakeholders to and use of data, information and digital innovations, and increasing the decision-making capacities of smallholder farmers. Scientists will communicate their research effectively to ensure that the findings influence policies and practices related to rice-based agri-food systems, and benefit those in greatest need.

Android-based app RiceAdvice enables extension personnel to advise farmers on their own fields and crops



‘Big data’ systems will contribute to job creation, increase access to innovations and help build more resilient livelihoods in rural and peri-urban areas relying on complex agri-food systems.

Technological advances are sweeping across Africa and increasing numbers of organizations, including farmers, rely on information technology to provide real-time information and knowledge in digital formats. Applications such as e-registration of RVC stakeholders allows farmers to be targeted with appropriate inputs, including financial services. Market information systems enable producers to access real-time information on prices in national and regional markets, so reducing the risk of exploitation by intermediaries. Consumers are also increasingly demanding real-time information on the quality of the milled rice they consume, in terms of its environmental and social sustainability. Digitization and automation of the rice food system therefore enable efficient market links, respond to consumers’ needs and address regulatory requirements. E-learning enables increased numbers of extension workers and farmers to access information and knowledge.

High-resolution drone images can accurately estimate land surfaces cultivated with rice, potential yields, and yield losses resulting from diseases, pests and abiotic stresses. At the field level, drone images allow the high-throughput phenotyping needed to make breeding more efficient and assess new rice entries of interest as parental lines for crossing program materials targeted at specific agro-ecosystems. Digital outputs can be used by government agro-statistics and planning offices or NGOs for informed policy- and decision-making, and targeting of interventions in the rice-based agri-food system. Drones can facilitate the automation of agro-inputs or treatments to larger

cropping areas, with private companies offering these kinds of services.

AfricaRice has already developed a range of digital tools and e-learning modules, and the new strategy will focus on increasing the scale of their use. These include E-Smart Valleys, RiceAdvice and WeedManager. In addition to providing valuable information to a much wider audience, the integration of digital applications and tools in technology development and scaling will create job opportunities for youth and agri-entrepreneurs to become agents of transformation in the rice sector. Phyto-digitization of production systems, ecosystems and crop growth stages will greatly increase access to knowledge and aid the diagnosis of production challenges, as well as promoting coordination among stakeholders.



Above: ICT for genebank field operations  
Left: E-Smart Valleys homepage



AfricaRice nurtures a culture of effective internal and external communication, coupled with clear and supportive policies and procedures. Effective communication is essential to disseminating information on AfricaRice programs, results and impacts, increasing research impact and enhancing visibility in the transformation of rice-based agri-food systems in Africa. AfricaRice will engage further in policy dialogue to scale up results through interactions with numerous national and regional bodies, and through developing and communicating results of policy analyses. The target audience includes policy-

makers (notably the AfricaRice Council of Ministers), donors, research partners, development partners, universities, NGOs, the private sector, trainees and students, RVC actors, the media and the general public. Knowledge-sharing and dialogue will be facilitated to better engage the key stakeholders.

Communication specialists will manage branding to strategically position a single rice-based program for Africa and foster collaboration among CGIAR centers and NARES in support of regional initiatives promoting rice self-sufficiency and healthy livelihoods. Effective communication channels and tools and consistent messaging will be used to engage with stakeholders. Expertise and strategic guidance will be provided to researchers and partners to enhance effectiveness, impact, public image and donor support. Documenting, publishing, communicating and disseminating research knowledge and products will be organized for wide accessibility and use through reports and social media. This will ensure that AfricaRice continues to play its role as the

primary source of information and knowledge in the transformation of rice-based systems in Africa.

AfricaRice has 50 years' experience of research, and its rice sector development expertise combined with the knowledge of its sister organizations will be visible in the One CGIAR Research Areas. These will form the basis for organizing and delivering rice research products through two regional initiatives in West and Central Africa, and Eastern and Southern Africa. Communication about the programs, science, results and progress will use an array of tools, including specific project websites, newsletters, media briefs, radio and TV interviews, podcasts and blogs. Information and resources will be open and accessible through open-access applications and intellectual asset management strategies.

A key part of the communications strategy is to support the quality and effectiveness of the Center's partnerships, and to help ensure strong engagement of African partners. With support from AfricaRice research leaders and management, the strategy will

embrace the following: (i) awareness of partners' concerns and sensibilities to One CGIAR will be maintained and reflected appropriately; (ii) full and proper attribution will be provided for all who have contributed to the Center's work and success in stories, reports and other external communications; and (iii) relevant support and strategic guidance will be provided for communication to member countries about rice-based systems transformation.

### 3.5. Multiple benefits across multiple impact areas

The new strategy will generate several key pathways from science and innovation, resulting in multiple benefits. The AfricaRice intervention domains are interlinked with innovations, partnerships, capacity development and policy engagement, each complementing and reinforcing the others. Through these channels, interdisciplinary research and innovation systems geared toward building solutions to address the most pressing challenges for rice-based agri-food systems, and connected by a common mission, will generate positive shifts in the environment, livelihoods, equality, nutrition and climate impact spaces. The new rice strategy contributes to most SDGs but will focus primarily on tackling challenges of the rice sector in Africa to realize multiple benefits across the five global One CGIAR Impact Areas as a collective. These five Impact Areas are also closely linked to the SDGs and particularly to SDG 2, which is the mission focus of the new strategy. **Table 1** presents the way in which the new strategy aims to deliver multiple benefits across the One CGIAR Impact Areas.

Germination (viability) testing in the genebank



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TABLE 1

## DELIVERING MULTIPLE BENEFITS ACROSS THE ONE CGIAR IMPACT AREAS

Impact Area	System transformation	Resilient agri-food systems	Genetic innovation
<b>Nutrition, health and food security</b> 	<p>Policy reforms to ensure rice-based agri-food systems and products are competitive with imported products.</p> <p>Information technology measures and advocacy to inform the population on food safety and nutrition.</p>	<p>Diversification of rice-based systems with nutritious products such as fish, beans and vegetables will improve the nutritional status of local people.</p> <p>Sustainable intensification and promotion of rice-based food in valleys (Smart-valleys).</p>	<p>High-yielding and disease-resistant varieties with key nutrients (iron, zinc and protein).</p> <p>Aromatic, low-to-medium amylose content and soft-cooking rice with market competitiveness.</p> <p>Taking to scale the technology of parboiled rice, providing increased opportunities to improve health.</p>
<b>Poverty reduction, livelihoods and jobs</b> 	<p>Promoting integrated business models and hubs to improve business-to-business practices among rice-based value chain actors and to increase employment along the value chain.</p> <p>Demand-led value chain and market development (market actors) to inform AfricaRice and its partners on the relevance of its breeding and seed systems work.</p>	<p>Increased profitability through agronomic interventions and farm diversification.</p> <p>Dissemination of small-scale harvesting and threshing technologies, and mechanization.</p> <p>Climate-proof rice-based management practices developed and disseminated to increase labor productivity.</p> <p>Utilization of ICT tools such as RiceAdvice to enhance job opportunities in the agriculture sector.</p>	<p>Promotion of breeding programs for high-yielding, climate-smart varieties and hybrids.</p> <p>Development of requisite protocols of a decentralized seed system to enhance timely access to genetic innovation.</p> <p>Improved access to climate-smart varieties and improved production activities to support breeder and foundation seed supply to seed enterprises for production and delivery of certified seed to farmers.</p> <p>Rice varieties with at least 5% yield advantage over present varieties leading to increased productivity and income generation.</p>
<b>Gender equality, youth and inclusion</b> 	<p>Design and promotion of evidence-based policies that are gender responsive and youth targeted, developing youth entrepreneurship and facilitating access to land, finance and markets for youth entrepreneurs.</p> <p>Digital innovations that promote access to business hubs along the agri-food value chain and commodity markets by women and youth, and innovations in finance that improve competitiveness.</p>	<p>Dissemination of women-friendly postharvest processes (e.g. parboiling systems, cleaning and grading, bakery recipes).</p> <p>New agronomic interventions (including mechanization options and digital solutions) designed to enhance job opportunities, particularly for women and youth.</p>	<p>Promotion of gender-sensitive participatory variety selection processes that will allow women, men and youth to determine their preferred rice variety traits.</p> <p>Certified seed production training in different parts of Africa for groups of youth and women; delivery of certified seeds for women's associations.</p> <p>Gender-sensitive rice product profiles.</p>

Impact Area	System transformation	Resilient agri-food systems	Genetic innovation
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**Climate adaptation and mitigation**



Evidence-based ex-ante and ex-post assessments of technological innovations that show the progress made in adaptation to and mitigation of climate change.

Institutional strengths of national and regional stakeholders enhanced in adaption to climate change through specific capacity-building practices.

Renewable energy sources adopted at scale and institutions increase their adaptation and resilience to climate change.

Climate-proof crop management options tested and made available to enhance the adaptability of the system and reduce risks of production failure.

Development and promotion of new early maturing varieties with improved tolerance to drought, cold, pests and diseases.

Rice management practices that reduce GHG emissions and increase crop diversification to de-risk farmers from climate change effects.

Rice production extensification through climate-smart agriculture such as Smart-valleys and 'alternate wetting and drying'.

Climate information services introduced.

Genetic innovation by developing and disseminating varieties tolerant to drought, salinity, extreme temperatures (heat and cold) and submergence, with the right package of traits against multiple abiotic constraints.

Rice varieties responding positively to microbial associations leading to reduced fertilizer use and GHG emissions.

High-yielding, stress-tolerant rice varieties adapted to dry direct-seeded aerobic conditions to save water and labor.

**Environmental health and biodiversity**



Making climate-proof rice-based agri-food systems the nexus for improving public and environmental health.

Enabling a conducive policy environment that will sensitize rural and urban populations and the private sector to environmental health and biodiversity conservation.

Developing potential impact pathways of rice-based food systems in agro-ecosystems, ensuring these are better understood.

Improved crop management practices to increase resource use efficiency (water, nutrients).

Sustained soil fertility improvements through farm diversification.

Smart-valleys agri-food systems as a mechanism for the good governance of land, water and forests offering a participatory and sustainable approach to reduce land degradation.

Early maturing varieties with high nutrient- and water-use efficiencies; rice varieties tolerant to nutrient toxicities such as iron toxicity; where appropriate, perennial rice varieties requiring minimal soil preparation and fertilizer application.

Optimal rice-legume (e.g. with *Mucuna*, *Stylosanthes*, *Crotalaria*) fallow systems to restore the productivity of the land.

# IMPLEMENTING THE NEW STRATEGY

## Six R4D initiatives will drive the implementation of the new strategy

AfricaRice and its partners have built a set of core competencies in R4D to assist member countries in addressing some of Africa's most pressing needs. These competencies are reflected in the diverse and integrated projects and services the Center is executing. A prospectus consisting of six R4D initiatives, which are fully aligned with the One CGIAR vision and mission, will drive the implementation of the new strategy. These initiatives are currently budgeted modestly at about US\$ 10 million each but have the potential to grow substantially over time, serving as a long-term financing platform for other multilateral and bilateral R4D partners. These research initiatives will contribute to the desired outcomes and thus to the five CGIAR Impact Areas and the SDGs. They will link directly to the three One CGIAR Action Areas (Systems transformation, Resilient agri-food systems and Genetic innovation) and will be implemented through national and regional partners and stakeholders. They will also offer huge opportunities to create strong and lasting synergies with other One CGIAR global and thematic initiatives by acting as clients taking on propositions for research and innovation, while also informing the adaptation of global initiatives through feedback.



Mini-GEM parboiler with processors

**Table 2** presents an overview of the six initiatives for which AfricaRice will seek investment. These potential business cases could also be pursued under the umbrella of One CGIAR in synergy with future global and regional initiatives, with support from either the pooled funding window or bilateral funding.

**TABLE 2** AFRICARICE RESEARCH-FOR-DEVELOPMENT INITIATIVES

*Initiative 1*

01

<b>Proposed title</b>	Sustainable rice-based food system transformation in sub-Saharan Africa
<b>One CGIAR Action Areas</b>	<ul style="list-style-type: none"> <li>• Systems transformation</li> <li>• Resilient agri-food systems</li> </ul>
<b>One CGIAR Global and Regional Initiatives</b>	<ul style="list-style-type: none"> <li>• Market-driven, resilient and nutritious agri-food systems in the humid zones of West and Central Africa</li> <li>• Enabling gender and social equality through resilient and inclusive agri-food systems (Genetic Innovation [GI])</li> <li>• Food systems transformation for sustainable healthy diets (GI)</li> </ul>
<b>CGIAR Impact Areas and SDGs</b>	 
<b>Key challenges</b>	<ul style="list-style-type: none"> <li>• By 2026, Africa will have the second highest per-capita rice consumption in the world with rice imports amounting to US\$ 6 billion. By 2030, the supply-demand gap could reach US\$ 11 billion</li> <li>• About 389 million people (43% of the population of SSA) live below the poverty line of US\$ 1.90/day</li> <li>• The number of undernourished people in Africa increased from 196 million in 2005 to 256.1 million in 2018</li> </ul>
<b>Goal and outcome</b>	<p><b>Goal:</b> To reshape the rice-based food system to substitute imports and provide a balanced and safer diet for rural and urban populations</p> <p><b>Outcome:</b> Rice-based food systems provide profitable and attractive business options through sustainable scaling up of technological and institutional innovations</p>



**Proposed title**

Sustainable rice-based food system transformation in sub-Saharan Africa

**Key results**

- Sustainable investment mechanisms to stimulate PPPs and catalyze country investments in the rice-based sector
- Market and private sector demand-pull business models and gender-sensitive access to finance, and input and output markets along the food system are tested and deployed
- Evidence-based and impact-driven packages of technological and institutional innovations to ensure adoption and interconnected impact are co-developed and promoted
- Digital-based agriculture for diversified and climate-smart rice-based production systems are promoted
- Best fit investment models to attract private, public and foreign investments with the help of CIPRISSA\* tool are co-designed, validated and scaled out

**Key partners\***

AfricaRice, Africa-wide Rice Policy Task Force, IRRI, Bill & Melinda Gates Foundation, GIZ, CARD, AU, ECOWAS, UEMOA, ECCAS, EAC, CORAF, ASARECA, CCARDESA, FARA, IFPRI, WUR, KAFACI/RDA, ROPPA, PROPAC, EAFF, SACAU.

**CGIAR regions**



**Proposed budget**

US\$ 15 million

\* See abbreviations list.

**Proposed title** Linking production to input and output markets for rice self-sufficiency in Africa

**One CGIAR Action Areas**

- Systems transformation
- Resilient agri-food systems

**One CGIAR Global and Regional Initiatives**

- Enabling gender and social equality through resilient and inclusive agri-food systems (GI)
- Food systems transformation for sustainable healthy diets (GI)

**CGIAR Impact Areas and SDGs**

**Key challenges**

- Limited access by smallholders to new and market-preferred mega rice varieties, input and output markets, including markets for finance
- Low-quality competitiveness of local rice compared with imported rice in urban coastal markets
- High level of risk and uncertainty in rice production and marketing
- Susceptibility to and contribution of rice production to climate change
- Limited sound agricultural policies and holistic approaches to facilitate an equitable and adequate use of resources (land, water, energy, inputs, finance), reduce food loss and waste, facilitate access to viable markets, increase food safety for health, and increase use of by-products for feed, energy and fertilizer

**Goal and outcomes**

**Goal:** To transform subsistence rice-based farming into lucrative commercial and professional farming

**Outcomes:**

- Coupling of technological and institutional innovations improves markets and access to finance, and reduces risks for smallholders
- Rice agri-food farming is more productive and resilient to generate adequate incomes
- Consumers’ need for healthy and nutritious diet is satisfied

<b>Proposed title</b>	Linking production to input and output markets for rice self-sufficiency in Africa
<b>Key results</b>	<ul style="list-style-type: none"> <li>• Relevant financial products and digital solutions for resilient rice innovations are available and adopted</li> <li>• Private-led contractual arrangements to reduce risk, increase access to agro-inputs and services, and improve governance of rice-based food systems are co-developed and implemented</li> <li>• Resilience of smallholder farmers is increased through digital agriculture, extension and climate information services</li> <li>• Input and output market integration promoted to increase rice supply, farm revenues and household incomes</li> <li>• Domestic RVCs are upgraded and able to compete with imports</li> <li>• Strategies to reduce the contribution of rice farming to GHG emissions are assessed and scaled out</li> <li>• Sound policy options are available to encompass co-designed agri-food measures and their trade-offs</li> <li>• Strategies to reduce postharvest losses, and add value to rice and rice by-products are assessed and promoted</li> </ul>
<b>Key partners*</b>	AfricaRice, Manobi Africa, IRRI, Syngenta Foundation, ESOP, NARES, universities (WUR, University of Arizona).
<b>CGIAR regions</b>	
<b>Proposed budget</b>	US\$ 10 million

\* See abbreviations list.

**Proposed title** Business models for women and youth entrepreneurship for food system transformation

**One CGIAR Action Area** Systems transformation

**One CGIAR Global and Regional Initiatives**

- Enabling gender and social equality through resilient and inclusive agri-food systems (GI)
- Market-driven, resilient and nutritious agri-food systems in the humid zones of West and Central Africa (Regional Integrated Initiative [RII] for West and Central Africa)

**CGIAR Impact Areas and SDGs**

**Key challenges** Africa’s youth population is expected to double, reaching 830 million by 2050. If properly harnessed, this increase in the working-age population could support productivity and stronger, more inclusive economic growth across the continent. Today, most of the youth in Africa do not have stable economic opportunities. Of Africa’s nearly 420 million youth aged 15–35 years, one third are unemployed, which promotes increased migration and risks social unrest. Similarly, the poverty rate among women is relatively high. Barriers and inequalities faced by various gender and demographic groups in rice agri-food systems remain high.

**Goal and outcomes**

**Goal:** To integrate youth and women at all levels of rice-based food systems through gender-responsive policies, access to economic resources, and business opportunities

**Outcomes:**

- Young people and women access productivity-enhancing resources to start up and improve their businesses
- Rice agri-food systems generate opportunities for women and youth through the use of gender-sensitive innovations
- Evidence-based gender-responsive policies and actions are promoted

<b>Proposed title</b>	<b>Business models for women and youth entrepreneurship for food system transformation</b>
<b>Key results</b>	<ul style="list-style-type: none"> <li>• Potential of youth and women in the transformative processes of rice-based food systems are harnessed</li> <li>• Self-employment and services using digital tools provide opportunities and investment for youth and women in the rice-based food system</li> <li>• A policy environment conducive to gender and youth integration at all levels of the rice-based food system is established</li> <li>• Barriers and inequalities faced by various gender and demographic groups in rice agri-food systems are reduced through more inclusivity in decision-making and access to and control over resources, incomes and assets, and in households and communities</li> <li>• On-farm and off-farm income opportunities for women and youth are expanded</li> <li>• Policies that are gender neutral or exclusive to the youth in terms of necessary resources and skills are co-designed and promoted</li> </ul>
<b>Key partners*</b>	AfricaRice, IFPRI, AWARD, ECOWAS, UEMOA, ECCAS, EAC, NARES, IRRI, IITA, Gender Platform, Syngenta Foundation, universities (WUR, University of Arizona).
<b>CGIAR region</b>	
<b>Proposed budget</b>	US\$ 10 million

\* See abbreviations list.

**Proposed title** Integrated development of inland valleys in sub-Saharan Africa

**One CGIAR Action Area** Resilient agri-food systems

**One CGIAR Global and Regional Initiatives**

- Market-driven, resilient and nutritious agri-food systems in the humid zones of West and Central Africa (RII for West and Central Africa)
- Implementing nature-positive solutions to enhance system productivity and resilience, safeguard the environment, and promote inclusive growth

**CGIAR Impact Areas and SDGs**




**Key challenges** Large areas of lowland, inland valleys and flood plains are yet to be exploited by agriculture and other economic activities in SSA to offer more nutritious and quality food throughout the year. The optimized use of water in these inland valleys through partnerships with local communities and the private sector along the value chain of rice-based systems (including vegetables and tubers) contributes to higher yields, crop diversification, better nutrition and input responsiveness of rice and other crops. Opportunities offered by this system to increase the availability of balanced diets (including protein from freshwater fish, prawns and vegetables) through rice-fish systems, such as the European Union-funded DeSIRA\* Integrated Rice-Fish Farming Project in Liberia, have not yet been fully exploited.

**Goals and outcomes** Farmers growing crops in inland valleys will increase productivity and incomes and become more resilient to climate change when they adopt the suggested diversification and intensification options. Expanding the cultivation area will create job opportunities, benefiting a wider range of people, especially women and youth.

**Key results**

- Development plans for inland valleys, including conservation agriculture measures, co-designed with partners
- Sustainable and diversified rice-based systems including rice, fish, vegetables and conservation agriculture developed
- Digital applications (RiceAdvice, WeedManager and e-learning) will be applied to manage smart valleys, increasing incomes of smallholder farmers, creating job opportunities for service providers, benefiting women’s groups, limiting the impact of agricultural intensification on the landscape, preserving biodiversity and contributing to the mitigation of climate change effects through adoption of direct seeding and alternate wetting and drying cropping agronomy approaches



**Proposed title**

Integrated development of inland valleys in sub-Saharan Africa

**Key results continued**

- Plant health threat identification and management tools (monitor pathogen diversity and genetic changes in pathogen populations, epidemiological modeling and eco-friendly and climate-smart IPDM\* innovations)

**Key partners\***

AfricaRice, WorldFish, IITA, IRRI, EiA, WorldVeg, and NARES and SMEs in target countries

**CGIAR region**



**Proposed budget**

US\$ 10 million

\* See *abbreviations list*.

Upland rice–peanut intercrop in conservation agriculture, Madagascar



**Proposed title** Integrated rice breeding platform for Africa

**One CGIAR Action Area** Genetic innovation

- One CGIAR Global and Regional Initiatives**
- Accelerated breeding: meeting farmers’ and consumers’ needs with nutritious, climate-resilient crops
  - Accelerating crop improvement through precision genetic technologies
  - Enabling traits, tools and technology services for genetic gains
  - Conservation and use of genetic resources

**CGIAR Impact Areas and SDGs**



- Key challenges**
- Climate change vulnerability, rapid population growth
  - Africa’s rice consumption–production gap is widening, and rice imports are unsustainable for local economies
  - Rice breeding in Africa is often supply focused and fails to sufficiently take the quality competitiveness of domestic versus imported rice into account
  - African countries rely on AfricaRice and other CGIAR centers to develop and foster the replacement of old varieties by new preferred rice varieties
  - A common rice breeding strategy has been adopted by AfricaRice and IRRI as part of the global OneRice Program. Efforts are underway with EiB\* and CtEH\* to modernize rice breeding in Africa. It is critical that NARES are fully integrated in this effort

- Goals and outcomes**
- Goals:**
- Integrated rice breeding program and effective Africa-wide breeding network
  - Increased genetic gain in farmers’ fields
  - Demand creation and variety release through multilocational testing of advanced breeding lines
  - Product profiles validated by AfricaRice and its national and international partners to develop market-preferred varieties
  - Improved, rapid-cycle breeding pipelines established at AfricaRice, IRRI and national breeding programs that deliver rates of genetic gain of at least 1.5% annually in farmers’ fields



Proposed title	Integrated rice breeding platform for Africa
<b>Goals and outcomes continued</b>	<p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Countries modernize and standardize breeding programs, and increase breeding efficiency and effectiveness with a good return on investment</li> <li>• Breeders incorporate market intelligence into product profiles and develop varieties that respond better to stakeholders’ needs and help domestic rice compete against imports</li> <li>• An effective system for identifying improved varieties is linked to dissemination networks of national partners to ensure their rapid and widespread adoption</li> <li>• Rice varieties adapted to diversified production systems (rice–fish, rice–livestock, rice–vegetables, legumes, cereals or tree crops) and systems with reduced emissions of GHGs (e.g. aerobic rice and rice–microbe associations), developed for improved nutrition and sustainable use of natural resources</li> <li>• Routine use of molecular approaches by AfricaRice, IRRI and national breeding programs to mobilize useful genes/alleles from elite and wild gene pools into superior genetic backgrounds for rapid development of adapted, input-efficient and more nutritious rice varieties</li> </ul>
<b>Key results</b>	<ul style="list-style-type: none"> <li>• Product profiles produced for SSA targeting 11 priority market segments validated by actors in the RVC including male and female farmers, millers and consumers</li> <li>• Gender-specific rice preference data developed along the RVC across SSA and used for designing product profiles</li> <li>• A network of key testing sites with fully mechanized breeding operations and automated data collection, management and processing, for rapid turnover of high-quality data, established across SSA</li> <li>• Modernized and standardized breeding protocols including those for line development and testing (high-throughput phenotyping and genotyping for biotic and abiotic stresses and grain quality) established at key testing sites</li> <li>• A system established for regular monitoring and evaluation of key performance indicators to assess the progress in modernization of breeding programs</li> <li>• Online and easily accessible catalogues of popular and new rice varieties in Africa created to enhance rapid varietal diffusion and promote regional trade across the continent</li> <li>• Nutrient-rich (iron, zinc and protein) and low glycemic index rice varieties that are preferred by farmers, processors and consumers available for scaling up</li> <li>• Molecular breeding platforms established, where national breeding programs work in tandem with AfricaRice and IRRI molecular breeding teams</li> <li>• Breeding networks, including AfricaRice, IRRI and national partners, strengthened through training, networking and the Africa-wide Rice Breeding Task Force to promote the rapid identification and deployment of new improved varieties</li> <li>• Platform developed to support monitoring of rice disease epidemics in case of extreme weather events</li> </ul>
<b>Key partners*</b>	AfricaRice, IRRI, CIAT, Bill & Melinda Gates Foundation, USAID, EIB, IFAD, IRD, JIRCAS, CIRAD, GIZ, AfDB, IsDB, UEMOA, CORAF, NARES partners, 15–20 major rice-growing countries in SSA

**Proposed title** Integrated rice breeding platform for Africa

**CGIAR regions**



**Proposed budget** US\$ 10 million

\* See abbreviations list.

Rice and fish trial at AfricaRice



<b>Proposed title</b>	Enhancing quality rice seed delivery to improve food production and livelihoods of smallholder farmers in agri-food systems
<b>One CGIAR Action Area</b>	Genetic innovation (Outreach, partnerships and scaling)
<b>One CGIAR Global and Regional Initiatives</b>	Market-driven, resilient and nutritious agri-food systems in the humid zones of West and Central Africa (RII)
<b>CGIAR Impact Areas and SDGs</b>	 
<b>Key challenges</b>	<p>Rice seed systems in Africa are underdeveloped relative to the maize seed system. The involvement of the private sector, access to new genetic materials and links with the national seed regulatory system and markets remain weak. Nascent rice seed businesses, most of which are SMEs, generally lack technical and business capacities and financial means to produce and market seeds. There is little promotion of quality rice seed through on-farm demonstrations and field days, and other information and communication media are weak. Existing SMEs are not widely linked to the millers that promote milled rice within and across countries, leading to disharmony between production and marketing within the RVC. In this context, AfricaRice facilitated the establishment of a PPP through COSEM-Riz* to produce and market quality rice seed of improved and climate-smart market-preferred rice varieties.</p>
<b>Goal and outcomes</b>	<p><b>Goal:</b> To sustainably enhance the national rice seed systems and seed delivery mechanisms through PPPs for the benefit of smallholder farmers.</p> <p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Sustainable national and regional seed systems established through a PPP with COSEM-Riz as the entry point and catalyst</li> <li>• New and mega market-demanded rice varieties including hybrids increasingly occupy the rice agri-food system</li> <li>• Enhanced national and regional seed policy implementation with the active involvement of seed enterprises and millers</li> <li>• Cross-border trade in quality seed facilitated and variety replacement enhanced</li> <li>• Opportunities and retention of workers at the level of seed enterprises and millers enhanced</li> <li>• Digitization of seed production and commercialization process promoted within the seed system to enhance traceability and reduce counterfeit seed sale</li> </ul>

 No poverty	 Zero hunger	 Gender equality	 Climate action	 Life on land
 Nutrition, health and food security	 Poverty reduction, livelihoods and jobs	 Gender equality, youth and inclusion	 Climate adaptation and mitigation	 Environmental health and biodiversity

<b>Proposed title</b>	Enhancing quality rice seed delivery to improve food production and livelihoods of smallholder farmers in agri-food systems
<b>Key results</b>	<ul style="list-style-type: none"> <li>• Quality rice seed available to seed enterprises, millers and farmers</li> <li>• Market information system or electronic platform to promote rice seed enhanced</li> <li>• Policy engagement to facilitate the timely release and deployment of quality seed of new and mega rice varieties in agri-food systems enhanced</li> <li>• Capacity enhanced through networking, experience-sharing and learning</li> <li>• Multistakeholder process to ensure inclusivity and impact at scale mainstreamed in rice sector development hubs</li> </ul>
<b>Key partners*</b>	COSEM-Riz, Africa-wide Rice Breeding Task Force, IRRI, national seed agencies, farmer groups, ROPPA, PROPAC, EAFF, SACAU, phytosanitary agencies, customs, ECOWAS, COMESA, SADC, CORAF, ASARECA, CCARDESA.
<b>CGIAR regions</b>	
<b>Proposed budget</b>	US\$ 5 million

\* See abbreviations list.

# TRACKING PROGRESS AND MEASURING IMPACT

The new strategy is aligned to the One CGIAR 2030 Research and Innovation Strategy and will adopt the One CGIAR Performance and Results Management Framework 2022–2030.

A four-tiered monitoring, evaluation, learning and impact assessment (MELIA) framework will be established, comprising:

1. Impact of R4D projects that contribute directly to One CGIAR Impact Areas
2. Direct contributions to One CGIAR Action Areas by each investment initiative
3. Use of R4D innovations, dissemination effectiveness and adoptability of insights by countries
4. Creating impact at scale by each investment initiative.

In effect, the MELIA will:

1. Inform decision-making at critical junctures and highlight key success factors
2. Institutionalize country goals in line with national agricultural development plans
3. Help develop and roll out a portfolio of rice-based R4D solutions to transform rice-based agri-food systems
4. Help design proof of concept for transforming rice-based agri-food systems for adaptation to other countries on the basis of progress made in initial countries





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5. Empower a wider group of stakeholders to drive progress toward a healthier and more prosperous Africa by 2030 in line with the One CGIAR Impact Areas and SDGs.

## 5.1. Rice strategy key performance indicators 2022–2030

### 5.1.1. Indicators — Spheres of control and influence (outputs and outcomes)

The set of output and outcome indicators related to the spheres of control and influence are drawn from the 2017–21 CGIAR portfolio experience and optimized based on CGIAR 2022–2030 objectives. The indicators relate to products, capacity development, policies, partners and innovation scaling. An illustrative list is provided in Annex 1.

### 5.1.2. Indicators — Sphere of interest (impact)

The proposed AfricaRice indicators and targets are detailed in Annex 1, related to CGIAR Impact Areas and One CGIAR collective global 2030 indicators and targets.

Young seedlings characterization needs special care (genebank activity)

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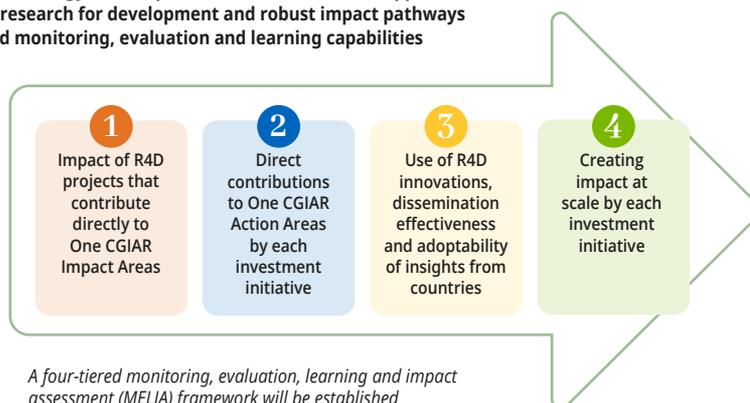
# ANNEX 1. TRACKING PROGRESS AND MEASURING IMPACT

## Rice strategy key performance indicators 2022–2030

*Transformation of Rice-based Agri-food Systems for Food and Nutrition Security in Africa: 2030 Rice Research and Innovation Strategy for Africa* is aligned to the One CGIAR 2030 Research and Innovation Strategy. AfricaRice will adopt the One CGIAR Performance and Results Management Framework 2022–2030 approved by the System Council at its 11th meeting on 17 December 2020 (SC/M11/DP2). The alignment will relate to relevant output and outcome indicators, and impact indicators.

### IMPACT PATHWAY

The Strategy will adopt a result-focused holistic approach to research for development and robust impact pathways and monitoring, evaluation and learning capabilities



### IMPACT ASSESSMENT FRAMEWORK



## Indicators — Spheres of control and influence (outputs and outcomes)

The set of output and outcome indicators related to the spheres of control and influence are drawn from the 2017–21 CGIAR portfolio experience and optimized based on CGIAR 2022–2030 objectives. An illustrative list is provided below and may evolve to suit needs over time.

1. **Products:** Number and type of products/ideas/services/solutions delivered.

*Product types:* (i) Genetic varieties; (ii) Production systems and management practices; (iii) Research and communication methodologies and tools; and (iv) Knowledge products — (a) Number of peer-reviewed journal papers and their uptake: AfricaRice research papers published in peer-reviewed journals (Open Access, ISI, citation indices, Altmetric attention score); and (b) Number of other knowledge products and their uptake, including: book chapters, maps and geospatial data, databases, grey literature, policy briefs, conference papers and posters, training materials

Black-seeded accession of *Oryza glaberrima*



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(Altmetric attention score, adherence to FAIR Principles — findable, accessible, interoperable, reusable).

2. **Capacity development:** Number of people trained (including Masters and PhDs) disaggregated by gender (women, men, youth).

*Change in the science and knowledge capacity of key* (i) Individuals; (ii) Organizations (government, civil society and private sector); and (iii) Networks (e.g. multistakeholder platforms).

3. **Policies:** Number of policies/strategies/laws/regulations/budgets/investments/curricula modified in design or implementation, informed by AfricaRice research.

*Three levels of maturity:* (i) research taken up by next user, (ii) policy enacted, and (iii) evidence of impact on people and/or environment of the policy.

4. **Partners:** Number, type and role of partners along impact pathways. Partner typology will align with an international standard, e.g. the International Aid Transparency Initiative (IATI).

5. **Innovation scaling:** Number of innovation packages (core innovations and supporting innovations).

- Innovation readiness (design, testing and validation of innovation) Level I: Discovery — Low innovation readiness; Level II: Successful piloting — Medium innovation readiness; Level III: Number of innovations available or ready for uptake — High innovation readiness.
- Innovation use (scaling of innovation) Level I: Uptake by project and partners — Low innovation use; Level II: Uptake by next user — Medium innovation use; Level III: Uptake by end user — High innovation use.

# Indicators — Sphere of interest (impact)

## AfricaRice indicators and targets

One CGIAR Impact Area	One CGIAR Collective global 2030 indicators and targets	Proposed common impact indicators and targets attributable to AfricaRice
<p><b>Nutrition, health and food security</b></p> 	<p>End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food.</p> <p>Reduce cases of foodborne illness (600 million annually)</p>	<ul style="list-style-type: none"> <li>• 60 million people benefiting from relevant AfricaRice innovations</li> <li>• 60 million people meeting minimum dietary energy requirements</li> <li>• 36 million people meeting minimum micronutrient requirements</li> <li>• Reduction by 12 million in cases of communicable and non-communicable diseases especially linked to type 2 diabetes and mycotoxin contamination</li> </ul>
<p><b>Poverty reduction, livelihoods and jobs</b></p> 	<p>Lift at least 500 million people living in rural areas above the extreme poverty line of US\$ 1.90 per day (2011 purchasing power parity).</p> <p>Reduce by at least half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.</p>	<ul style="list-style-type: none"> <li>• 15 million people benefiting from relevant AfricaRice innovations</li> <li>• 10 million people assisted out of poverty in Africa</li> </ul>
<p><b>Gender equality, youth and social inclusion</b></p> 	<p>Close the gender gap in rights to economic resources, access to ownership and control over land and natural resources for over 500 million women who work in food systems.</p> <p>Offer rewardable opportunities to 267 million young people who are not in employment, education or training.</p>	<ul style="list-style-type: none"> <li>• 5 million women benefiting from relevant AfricaRice innovations</li> <li>• 5 million women have more access to resources (finance, land, etc.)</li> <li>• 5 million youth benefiting from relevant AfricaRice innovations</li> <li>• 5 million youth and women empowered and included in the agricultural business models</li> <li>• 5 million youth and women assisted out of poverty</li> </ul>

One CGIAR  
Impact Area

One CGIAR Collective global 2030  
indicators and targets

Proposed common impact indicators and  
targets attributable to AfricaRice

**Climate adaptation  
and mitigation**



*Implement all National Adaptation Plans (NAP) and Nationally Determined Contributions (NDC) to the Paris Agreement.*

Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems.

Turn agriculture and forest systems into a net sink for carbon by 2050, with emissions from agriculture decreasing by 1 Gt per year by 2030 and reaching a floor of 5 Gt per year by 2050.

- 10 million small-scale rice-based farmers benefit from AfricaRice innovation that increase resilience to climate shocks
- 2 million tonnes CO<sub>2</sub>-equivalent emissions reduced
- US\$ 10 million in climate adaptation investments

**Environmental  
health and  
biodiversity**



*Stay within planetary and regional environmental boundaries:*

Consumptive water use in food production of less than 2500 km<sup>3</sup> per year (with a focus on the most stressed basins), zero net deforestation, nitrogen application of 90 Tg per year (with a redistribution toward low-input farming systems) and increased use efficiency; and phosphorus application of 10 Tg per year.

Maintain the genetic diversity of seeds, cultivated plants, and farmed and domesticated animals, and their related wild species, including through soundly managed genebanks at national, regional and international levels.

- 1 million ha under improved rice management practices
- 23,000 plant genetic accessions available and safely duplicated

# ABBREVIATIONS

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<b>AfDB</b>	African Development Bank	<b>COSEM-Riz</b>	Consortium of Rice Seed Enterprises and Millers
<b>ASARECA</b>	Association for Strengthening Agricultural Research in Eastern and Central Africa	<b>COVID-19</b>	coronavirus disease 2019
<b>AU</b>	African Union	<b>CtEH</b>	Crops to End Hunger
<b>AWARD</b>	African Women in Agricultural Research and Development	<b>DeSIRA</b>	Development of Smart Innovation through Research in Agriculture
<b>CAADP</b>	Comprehensive Africa Agriculture Development Programme	<b>EAC</b>	East African Community
<b>CARD</b>	Coalition for African Rice Development	<b>EAFF</b>	Eastern Africa Farmers Federation
<b>CCARDESA</b>	Centre for Coordination of Agricultural Research and Development for Southern Africa	<b>ECCAS</b>	Economic Community of Central African States
<b>CIAT</b>	International Center for Tropical Agriculture	<b>ECOWAS</b>	Economic Community of West African States
<b>CIPRISSA</b>	Continental Investment Plan for accelerating Rice Self-sufficiency in Africa	<b>eds</b>	editors
<b>CIRAD</b>	Centre de coopération internationale en recherche agronomique pour le développement	<b>EiA</b>	Excellence in Agronomy
<b>COMESA</b>	Common Market for Eastern and Southern Africa	<b>EiB</b>	Excellence in Breeding
<b>CORAF</b>	West and Central Africa Council for Agricultural Research and Development	<b>ESOP</b>	Entreprises de Services et Organisations de Producteurs
		<b>FARA</b>	Forum for Agricultural Research in Africa
		<b>GHG</b>	greenhouse gas
		<b>GI</b>	Genetic Improvement
		<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
		<b>IFAD</b>	International Fund for Agricultural Development

<b>IFPRI</b>	International Food Policy Research Institute	<b>R4D</b>	research for development
<b>IITA</b>	International Institute of Tropical Agriculture	<b>RBCA</b>	Rice Biodiversity Center for Africa
<b>IPDM</b>	integrated pest and disease management	<b>ROPPA</b>	Network of Farmers' and Agricultural Producers' Organizations of West Africa
<b>IRD</b>	Institut de recherche pour le développement	<b>RVC</b>	rice value chain
<b>IRRI</b>	International Rice Research Institute	<b>SACAU</b>	Southern African Confederation of Agricultural Unions
<b>IsDB</b>	Islamic Development Bank	<b>SADC</b>	Southern African Development Community
<b>JIRCAS</b>	Japan International Research Center for Agricultural Sciences	<b>SDG</b>	Sustainable Development Goal
<b>KAFACI/RDA</b>	Korea–Africa Food and Agriculture Cooperation Initiative/Rural Development Administration	<b>SME</b>	small- and medium-sized enterprise
<b>MELIA</b>	monitoring, evaluation, learning and impact assessment	<b>SSA</b>	sub-Saharan Africa
<b>NARES</b>	national agricultural research, extension and education systems	<b>UEMOA</b>	Union Economique et Monétaire Ouest Africaine
<b>NGO</b>	non-governmental organization	<b>USAID</b>	United States Agency for International Development
<b>PPP</b>	public–private partnership	<b>WorldFish</b>	World Fish Center
<b>PROPAC</b>	Plateforme Régionale des Organisations Paysannes d'Afrique Centrale	<b>WorldVeg</b>	World Vegetable Center
		<b>WUR</b>	Wageningen University and Research

## About CGIAR

CGIAR is a global partnership that unites organizations engaged in research for sustainable development with the funders of this work. The funders include developing and industrialized country governments, foundations, and international and regional organizations. The work they support is carried out by 15 Centers, in close collaboration with hundreds of partner organizations, including national and regional research institutes, civil society organizations, academia and the private sector.



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## The Centers

<b>AfricaRice</b>	Africa Rice Center (Abidjan, Côte d'Ivoire)
<b>Bioversity-CIAT</b>	The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT)
<b>CIFOR</b>	Center for International Forestry Research (Bogor, Indonesia)
<b>CIMMYT</b>	International Maize and Wheat Improvement Center (Mexico, DF, Mexico)
<b>CIP</b>	International Potato Center (Lima, Peru)
<b>ICARDA</b>	International Center for Agricultural Research in the Dry Areas (Beirut, Lebanon)
<b>ICRISAT</b>	International Crops Research Institute for the Semi-Arid Tropics (Patancheru, India)
<b>IFPRI</b>	International Food Policy Research Institute (Washington, DC, USA)
<b>IITA</b>	International Institute of Tropical Agriculture (Ibadan, Nigeria)
<b>ILRI</b>	International Livestock Research Institute (Nairobi, Kenya)
<b>IRRI</b>	International Rice Research Institute (Los Baños, Philippines)
<b>IWMI</b>	International Water Management Institute (Colombo, Sri Lanka)
<b>World Agroforestry</b>	World Agroforestry (Nairobi, Kenya)
<b>WorldFish</b>	WorldFish (Penang, Malaysia)

Africa Rice Center (AfricaRice) is a pan-African Center of Excellence for rice research, development and capacity-building. It contributes to reducing poverty, achieving food and nutrition security, and improving livelihoods of farmers and other rice value chain actors in Africa by increasing the productivity and profitability of rice-based agri-food systems, while ensuring the sustainability of natural resources. AfricaRice is a CGIAR Research Center — part of a global research partnership for a food-secure future. It is also an intergovernmental association of 28 African member countries. AfricaRice headquarters is based in Côte d'Ivoire. Staff members are located in Côte d'Ivoire and in AfricaRice research stations in Liberia, Madagascar, Nigeria, Senegal and Uganda. For more information, visit [www.AfricaRice.org](http://www.AfricaRice.org).



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