Jayson C. Berto, PhilRice

Factsheet Resilience Solutions for the Rice Sector in the Philippines

This Factsheet is a part of the Private Markets for Climate Resilience (PMCR) project to evaluate systematically the potential market for climate resilience solutions in the private sector. Focusing on agriculture and transportation, current practices and opportunities highlight products, services and finance in six emerging markets — Colombia, the Philippines, South Africa, Nicaragua, Kenya, and Vietnam.

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Rice sector in the Philippines

With more than 7,000 islands and home to over 100 million people, the Philippines is endowed with rich natural resources. It is an agricultural country, with a fast-growing population, where over a quarter of the labour force is engaged in agriculture-related activities. Rice is the national staple and a political crop, representing a major source of income for millions of farmers. It is also a staple food for about 80% of the population and represents almost 23% of the total consumption of poor households and 10% of non-poor. The contribution of the rice sector to GDP is 0.7%, although its production generates about 38% of the total value of agricultural production.

In a country already described as Asia's "typhoon mat", the Philippines experiences an average of 20 typhoons annually climate change poses a major threat to Philippine rice production. Climate modelling scenarios predict that annual domestic rice production will fall to10.5 million tonnes in 2021, compared with current levels of 19 million tonnes. Climate change also aggravates the existing economic fragility of vulnerable small and poor farmers, facing both market and climate-related challenges such as drought, flooding, pest infiltration and crop diseases.

With an average annual income of USD 2,000, farmers continue to be among the poorest in the Philippines. Understanding the problem requires delving through the complexities of Philippine economic, social, political, and cultural systems. The main problems causing and contributing to the poverty and hardships of farmers include limited ownership of land, failure of land reform programs to address root causes of poverty, lack of access to modern and appropriate inputs, know-how, machinery and technology, limited access to credit and financing, post-production facilities and markets, and indiscriminate and illegal importation of rice and other commodities.

The resilience of the rice sector, and the agriculture sector in general, must be assessed in the context of national food security, as it is probably the most urgent, if not the most significant issue, that the country faces in the light of climate change.

Sector facts (2018)

Total production: 19.07 million tonnes
Total area of production: Palay (unhusked rice, the local name for a paddy) production occupies a total area harvested of approximately 4.8 million hectares (ha), representing 35% of the country's agricultural land.

Number, size and types of producers: The total number of farmers amounts to approximately 2.4 million, of which an estimated 62% self-finance their production activities. Most farmers are poor and old (average age 57 years), owning an average 1.4 ha farm area.
Average yield: 3.9 tonnes per ha

Key sector stakeholders: International Rice Research Institute (IRRI), Philippine Rice Research Institute (PhilRice), National Irrigation Administration and the Department of Agriculture.

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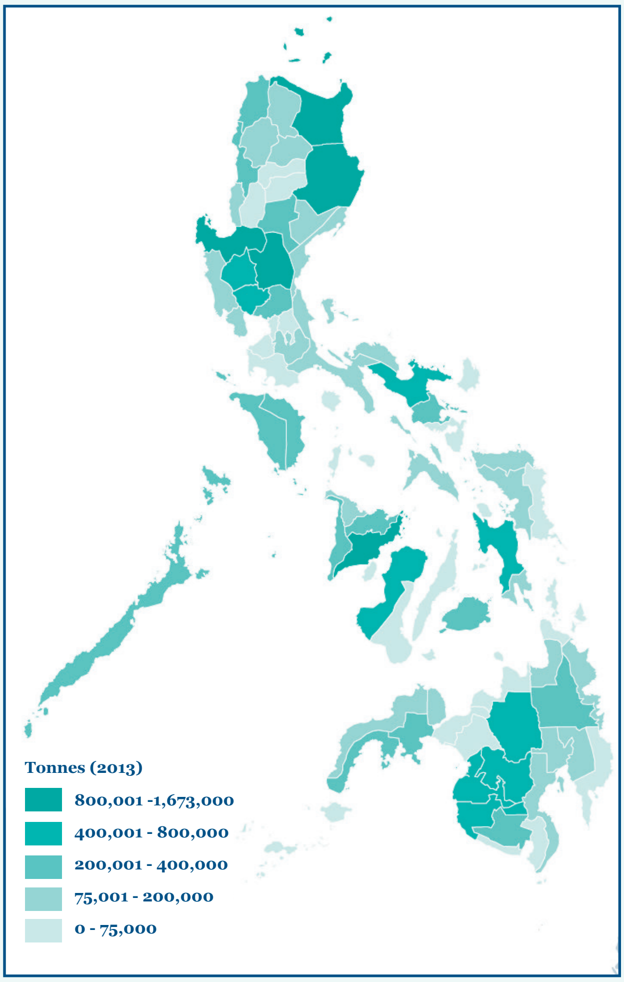
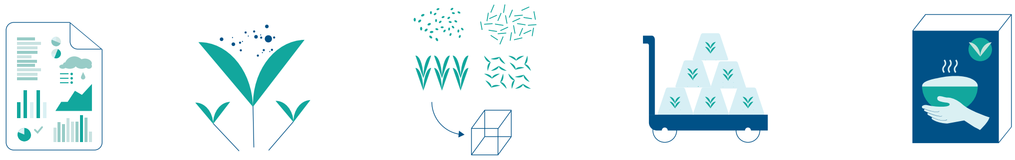
Philippines Rice Production



For a list of references, see the References Section of the PMCR Report.

The rice value chain

The rice value chain builds on five main processes from pre-production to consumption. Each process involves specific activities, which are conducted by direct actors and engage identified indirect actors.



	Pre-production	Production	Post-production	Distribution	Consumption
Activities	**Information collection:** climate forecasts, crop & land characteristics • Decisions on inputs and financing (labour, seeds & machinery) • Land preparation	**Crop management:** Planting, applying inputs, irrigation, monitoring growth indicators. **Non-routine problems:** pest outbreaks.	**Processing:** drying, sorting, milling, storing, and moisture management. **Product variety:** grains, husk for fuel brisket, stem and straw for animal feed, paper material and biowaste.	• Trading and transporting products to markets, wholesalers, retailers, customers and government. • Cleaning, sorting, packaging products.	• Selling products for local market or export.
Direct Actors	**Farmers, landowners & extension workers**		**Dryers, millers & storage owners**	**Wholesalers, retailers & farmers' associations**	**Consumers, manufacturers, government**
	Input suppliers & providers of irrigation services		**Traders & providers of logistics services**		
Indirect Actors	**Research centres – IRRI & PhilRice**	**Ministry of Agriculture** **Municipal agricultural office**	**Financial institutions (banks & MFIs)**	**Department of Trade and Industry**	**National Food Authority**

Normal environmental conditions for production

• Rice grows in *temperatures* above 10°C. This practically covers the whole Philippines, where the average annual minimum temperature is at least 23°C. Rice is also grown in mountainous regions where the climate is cooler. The highest reported elevation where rice has been growing is 1,500 meters above sea level.

• Rice crops require about 10 mm of water daily. With the development and government-mandated adoption of *alternative wet* and *dry technology*, the ratio of water needed to produce one kilo of rice has been reduced from five litres to one litre of water.

• Rice can be grown in the Philippines all year round and annually it is possible to grow at most three crops in a year.

• During the *wet season*, rice may be grown under rain-fed or irrigated conditions. As the year's last quarter is the typhoon season, it is recommended that harvesting takes place before October.

• During the *dry season,* rice naturally requires a consistent supply of water, for example, from a reliable irrigation system.

Changes in the weather that could affect production and the value chain

• *Temperature* is the main weather element that affects growth duration. Rice crops require a specific range of temperature to ensure ideal growth and harvest. Extremely *high temperatures* lead to a faster development rate, which is not ideal. It is estimated that a 1°C increase in the average annual minimum temperature could cause a 10% decline in yield.

• Rice crops need abundant *solar radiation* for carbohydrate assimilation. An ideal condition for high yield is one with a relatively *low temperature* and *high solar radiation* during the grain growth stage.

• If climate-related stress occurs during the vegetative stage, the plant may still recover, and the farmer may still enjoy a harvest. However, if the stress occurs around flowering time, recovery is difficult.

• Changes in *rainfall*, either in the form of *strong rains* or a continuous period of *no rain*, directly affect rice crops by impacting water availability. In many areas, there is currently no water provision for severe and prolonged droughts. If *irrigation systems* exist, they are poorly maintained and costly. Despite massive irrigation projects, water distribution for agriculture remains a continuing challenge.

• Relative *humidity* and *wind speed* are additional weather elements affecting rain-fed rice as they induce pests and diseases to multiply in the crop canopy, and may lead to soil erosion.

• *Flooding* affects rice production either by destroying harvestable goods or by restricting the transportation of products from farm to market. *Landslides* also have a significant negative impact on product transportation. For example, 10 days of continuous rain on a sloping area is a recipe for landslides.

• *Typhoons* also have a significant impact on sector productivity, especially if it they hit rice crops during the flowering stage.

B*Resilient Process Model

Each process of the value chain was assessed using the B*Resilient Process Model (BRPM), in order to identify the climate risks associated with each phase and the resilience options and tools available to address these risks, as well as to achieve specific resilience outcomes. The BRPM analysis of the ***Production*** process is presented below.

Resilience outcome	**Productive and resilient rice farms**		
Process: Production	**Application of inputs and planting**	**Crop monitoring & management**	**Responding to problems**
Risks	Extreme climate-related events like typhoons and floods Slow onset events like droughts, heat stress, and salinity	Pest and disease attacks and invasion	Extreme and slow-onset events increase risks for credit and insurance products Extreme events impact ability of farmers to cope and respond immediately
Actors	Farmers & landowners Suppliers of inputs Department of Agriculture Department of Environment and Natural Resources Local government units Media	Farmers & landowners Department of Science & Technology NGOs & foundations Media	Financial institutions Development Bank & Land Bank Lending groups (formal & informal)
Options & Tools	Agriculture resilience-focused laws and ordinances (e.g., irrigation, pest management, etc.) Stronger and better implementation of existing laws in both national and local levels Farm inputs & machinery Weather & climate data, new knowledge sources	More innovative and appropriate irrigation systems, natural pest control and management More aggressive shift to organic farming. Technology-based solutions, GPS and drones Guides and manuals for overall crop health checks	Farmer-friendly financing and loan packages More suitable and relevant crop insurance Banks hiring technicians to assist farmer-borrowers Innovative and organic solutions, pest /disease control and management

Nezara viridula, Carlo G. Dacumos, PhilRice

> *"Army worms (insects/pests) are mostly caused by climate change and use of excessive chemicals and imported fertilizers that are not approved by FDA. Farmers do not usually attend agriculture-related training; this is among the main reasons why they are not informed on new technologies."* ***Nueva Ecija Fruits and Vegetable Seed Center***

Resilience solutions

Identified resilience solutions in the rice sector in the Philippines vary from *solutions and technologies addressing water-related challenges*, to the *development of seed varieties* that are less vulnerable to climate change impacts, and *financing* and *risk management solutions*, among others.

Leading resilience solutions: *communal irrigation systems and seed development.*

Communal irrigation systems
Adequate and regular supply of water is key in rice production. As the rice deficit is expected to increase due to climate change, irrigation will be critical in maintaining rice yields and sustaining current production levels.

Particularly, in the early growth stages, the role of irrigation is crucial as plant development requires specific moisture levels. Moreover, chemical inputs can only be properly implemented in production, if there are adequate levels of water and moisture. Consequently, productivity in irrigated rice fields is ~43% higher than in rain-fed non-irrigated areas. Depending on the region, the production areas that are irrigated range between 50-90%. There are two separate irrigation systems:

i) *National irrigation system* (NIS) managed by the National Irrigation Authority (NIA) and services production areas with a minimum of 1,000 hectares, covering 44% of the country's irrigation services.

ii) *Communal irrigation system* (CIS) providing irrigation services to crop areas that fall below 1,000 hectares, covering 35% of the total irrigation system. The CIS started as a private initiative, but over time, has received significant government support for the cost of rehabilitation and new construction. Most CISs are constructed by the NIA and irrigation associations are responsible for the management and maintenance of the systems.

Resilience contribution: Good irrigation systems have the potential to minimize the negative effects of climate change. In addition to offsetting the negative effects, increasing the coverage of irrigation systems in all regions to 90% can improve domestic production from current levels.

Market opportunities: Analysis indicates that the rice gap may be reduced by expanding irrigation facilities in areas where irrigation is limited. Current irrigation facilities are challenged by inefficient design and maintenance. Improvement in design can address inefficient water flows, not only in terms of volume but also conveyance, while better maintenance can ensure general upkeep, such as cleaning and repairs. There is a need to build capacity in human resources for better management not only of the irrigation equipment and facilities but also of watershed sources to prevent erosion and siltation that pose additional risks to production. Investments in irrigation systems require significant financial resources. In the present structure, only 11% of irrigation is provided by the private sector. Although public-private partnerships (PPPs) are being considered, no operating model has yet been identified.

Seed development
A proven intervention that addresses the negative effects of climate change on rice production is the development of new varieties of rice seeds, which would continue to produce yields even in the face of calamity. With genetic enhancement, local rice varieties are able to better tolerate adverse conditions without compromising yield potential. For example, with flood-resilient seeds, rice plants could withstand two more weeks of being flooded instead of the standard time of three days. The potential to increase rice yield by 15-20% over inbred varieties in the face of climate challenges may help address food security concerns.

The Philippines hosts two important institutions in rice research, the International Rice Research Institute (IRRI) and the Philippine Rice Research Institute (PhilRice). Climate-smart seed varieties under research and development include properties that are resilient against *floods, drought, saltiness*, and *heat*.

Resilience contribution: With climate-smart seeds, rice crops could potentially be less vulnerable to floods, droughts and heat waves. Consequently, the financial profitability of rice producers could be sustained, despite the impacts of climate change.

Market opportunities: The development of new seed varieties must consider various aspects, from cost and implementation, to how farmers respond to new seeds. Climate-smart seed varieties are not yet available on a commercial level. Seed development requires intensive research capital, which drives up costs, and limits the scale of commercialization and uptake. Consequently, seed development and production still has a weak institutional base. With only three seed companies operating in the country at present, private sector engagement in seed production, marketing and extension services is limited. PPP models, such as terms for sharing seeds of parental lines, developing community seed bank system for farmers, and training on seed production, processing and storage are yet to be explored. And policy support and sustainable financing mechanisms will be paramount for large-scale uptake.

Main challenges related to resilience solutions

Institutional arrangements
PMCR study findings pointed out the crucial role the private sector in developing climate-smart rice seeds that can sustain the pressure of changing weather conditions. Similarly, in rice irrigation, private sector participation, for example through PPPs, can boost investment levels. But for this to happen, we will need new institutional arrangements in place that will ensure the profitability of PPPs, while at the same time incentivising private sector actors. Establishing viable and profitable PPP models requires clarity of contractual arrangements addressing specific problems in rice production, as well as structures to enhance financial viability and mechanisms to deal with policy interference. Additionally, crop insurance has been highlighted as a promising area where the private sector can assist rice farmers in minimizing their production risk.

M.A. Velas-Suarin

Policy and governance
The adoption of appropriate policies and governance structures can further encourage more active private-sector participation in climate change adaptation initiatives and activities. For example, land ownership remains a critical issue in the sector. Policies that take into account issues such as land ownership and financial constraints can boost the participation of the private sector and facilitate the uptake of adaptation and resilience solutions.

Knowledge and lessons learned
A deeper understanding of climate change is still needed in order to integrate the assessment of climate risks and the concept of resilience into all processes in the value chain. At the plantation level, most farmers base their decisions on instinct or past experience, often at the seasonal time scale, instead of using weather data to establish a climate-based crop calendar. As a result, farmers get "confused" as to when to sow their crops, and once a season is delayed, the next cropping rotation is also affected. Moreover, experiences and lessons learned from earlier roll-out programs, such as the hybrid seeds program in the early 2000s, should be taken into account.

*"Private sector actors are aware about climate change and the need for resilience in the agriculture sector; they even suggested projects for government such as, weather stations and rainwater harvesting systems... Farmers are aware of climate change — e.g., they say, "We are getting confused already, we don't know when is the right time to start planting..." Weather data and prediction are improving but farmers still get confused as to when to prepare their fields and start planting." **PhilRice Munoz, Nueva Ecija***

Maria Eliniesa A. Lucas

*"Farmers find it hard to avail of crop insurance for vegetables because they can only claim small amounts; many avail of insurance for rice (especially if they are subsidized). Insurance pay-out takes 3-4 months of processing. During a dialogue where municipal agricultural officers, traders and farmers were made to play a dice game that put them through decision making situations on purchasing insurance or investing in development, most of them said, "It is better to buy insurance rather than experience being wiped out by climate-related disasters"." **Municipal Agriculture Office, Bongabon, Nueva Ecija***