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Capacity Enhancement for Sustainable Source of High-Quality Seeds for Distribution in the Philippines

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ABSTRACT

Capacity Enhancement for Sustainable Source of High-Quality Rice Seeds for Distribution in the Philippines

The Philippines has a rich agricultural landscape with rice being the county's staple crop for the nourishment of its more than 100 million Filipinos across the country (2019 UN estimate). Because of its utmost importance, the government through its Department of Agriculture (DA) has always placed achieving rice sufficiency as its major target. While efforts to pursue this endeavor has always been of primary importance and after several decades, the country has yet to achieve this goal due to unfolding challenges as well as persisting concerns in the rice industry.

This project aimed to evaluate the value chain of the inbred rice seed industry to support the enhancement of the Philippines' national rice program. Specifically, it aimed to: 1) review the long- and short-term agricultural policies on rice seed value chain; 2) collect necessary data of the rice seed value chain to facilitate the analysis of the situations and circumstances in the Philippines; and 3) formulate practical recommendations relating to rice seed production and distribution system in the Philippines.

Data revealed that availability and timeliness in the supply of seeds play an important role in ensuring efficiency in the seed supply chain. Provision of varieties adaptable in the area within the planting schedule would discourage buying of seeds from illegal sellers or seed blowers who offer untagged seeds at a lower price but no assurance on quality. Seed quality is highly affected by processing and storage conditions and infrastructure to preserve its viability. If these are addressed adequately with proper infrastructure and equipment, efficiency in the rice seed value chain would significantly improve, resulting to a functional, demand-responsive rice seed industry.

Generally, the results of the focus group discussion (FGD) revealed that majority (75%) of CS produced by SGs are bought by the DA under its National Rice Program for seed buffer stock while the remaining are sold to farmers through dealers (25% and directly to farmers) in their locality. For Isabela SGs, however, 50% of their produce are sold to the DA, 40% to dealers, and 10% directly to farmers. Seed production cost per hectare in Nueva Ecija and Isabela are almost similar with an average cost of P61,456 (or about USD 1,200), and an average yield of 6 tons per ha. Majority of these expenses (about 65%) are spent on labor-intensive activities such as land preparation, transplanting, and harvesting; followed by fertilizer inputs at 15% and postharvest/processing activities at 10% while seeds only account to 3%.

Several issues were unfolded during the FGDs: 1) unavailability of preferred varieties of seeds during planting time; 2); presence of untagged seeds sold by illegal seed growers (seed blowers); 3) devolution of seed inspectors (SIs) under the LGUs whose functions are not limited to seed inspection but also other administrative functions; 4) inadequate access to accurate and timely information; 5) the impact of Philippine Rice Liberalization Law or RA No. 11203 to the local rice industry.

These issues were further analyzed and put into perspective to come up with recommendations that would resolve the root causes, and these are: 1) improvement of warehouse facilities with cold storage to ensure continuous supply of seeds regardless of different planting periods in the country; and 2) integration of the rice seed information system from seed production, certification, marketing and distribution. With a reliable supply of seeds due to improved infrastructure, purchase of untagged seeds from seed blowers or illegal traders would be discouraged. With seamless access to correct information, this would aid decision makers in crafting strategic plans and targets of the rice industry and monitoring current status of seed production at any given time.

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ABBREVIATION

AO	Administrative Order
ATI	Agricultural Training Institute
BPI	Bureau of Plant Industry
BPI-NSQCS	BPI-National Seed Quality Control Services
BPI-CRPSD	BPI-Crop Research and Production Support Division
BS	Breeder Seed
CES	Central Experiment Station
CS	Certified Seed
DA	Department of Agriculture
FGD	Focus Group Discussion
FS	Foundation Seed
GVA	Gross Value Added
ICT	Information and Communications Technology
IRR	Implementing Rules and Regulations
IRRI	International Rice Research Institute
ISGMPC	Isabela Seed Growers Multi-Purpose Cooperative
LGU	Local Government Unit
MC	Moisture Content
MOET app	Minus-One Element Technique Application
NCT	National Cooperative Test
NSIC	National Seed Industry Council
PCAARRD	Philippine Council for Agriculture, Aquaculture, and Natural Resources Research and Development
PhilMech	Philippine Center for Post-harvest Development and Mechanization
Php	Philippine peso
PhilRice	Philippine Rice Research Institute
PRIR	Philippine Rice Industry Roadmap
PSA	Philippine Statistics Authority
PSC	Provincial Seed Coordinator
RA	Republic Act
RCEF	Rice Competitiveness Enhancement Fund
R&D	Research and Development
RFO	Regional Field Office
RS	Registered Seed
RSC	Regional Seed Coordinator
RH	Relative Humidity
SG	Seed Grower
SI	Seed Inspector
SIDA	Seed Industry Development Act
SMSGMP	San Manuel Seed Grower Multi-Purpose Cooperative
SP	Seed Producer
S&T	Science and Technology
SUC	State Universities and Colleges
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TESDA	Technical Education and Skills Development Authority
TWG	Technical Working Group
UPLB	University of the Philippines Los Baños
VIG	Varietal Improvement Group

Introduction

Chapter 1

1. Background and Context

Seed is an important input in crop production and crop productivity depends largely on quality of seeds. Rice research had proven that use of high-quality seeds has 10-15% yield advantage over farmers' home-saved seeds. Mataia, *et al*. (2009) reported an 18% increase in yield with the use of certified seeds. Despite the yield advantage of using high-quality seeds, statistics show that the major seed source of rice farmers in many rice-producing countries is the farmers' home-saved seeds or thru the informal seed system which is based on local diffusion mechanisms. The quality of seeds also depends largely on seeds' viability expressing the physiological and productivity potential. The viability of the seeds spells out its quality from production to postproduction, and is highly affected at warehousing and storage when biotic (bacteria, insect, fungi, and viruses) co-occur with abiotic factors (temperature, humidity, and moisture content or MC) at favorable condition.

Vange et al., (2016) studied, however, that seed deterioration starts immediately after harvest and therefore, post-harvest handling of rice seed plays a key role in the maintenance of seed quality (as cited by Mutinda, et al. 2017). After harvest, rice seeds are dried down to 12-13% moisture content (MC), processed, cleaned, and stored at warehouses. At warehouse and storage, rice seeds need to be maintained at an appropriate temperature and MC to preserve their quality. Seeds need to be protected from damage by insects and other pests, such as rodents and birds. Insect infestation and bird activity can also increase and promote the growth of microorganism that causes spoilage and reduce the quality of seeds (Espino, Greer, Mutters, and Thompson, 2014). Hence, pest infestation greatly affects the quality of the seeds. Therefore, research is needed to improve seed management from harvest to warehousing and storage, and maintain the quality of seeds at storage for distribution.

With the enactment of Philippine Republic Act No. 11203 (RA 11203), the quantitative restrictions of imported rice are already lifted and thereby rice trade liberalization is now allowed. Having this, the Philippine government has promulgated a program to mitigate the effects of this free trade among farmers with the hope of enhancing rice competitiveness. It is now embarking to distribute quality seeds to farmers and help them organize themselves to become more cohesive, reliant, and competitive. Hence, the availability of seeds is very important because of the seasonality of production and the specific needs of the regions vary from each other in time, variety, and seed class. To ensure a steady source of higher seed classes, appropriate production and postproduction technologies, practices, and interventions shall be in place. The sustainability of the source of high-quality seeds for distribution is very critical to crop productivity. As PhilRice produces the higher seed classes necessary to eventually produce the certified seeds needed by the farmers, it is therefore proper that a sustainable source accompanied by an efficient system are put in place. Hence, to have this sustainability, analysis of the rice seed value chain especially those critical points from production (acquisition of seeds) to postproduction especially at warehousing and storage (inventory/stock) management as requisite to efficient distribution and post distribution are included in this research/survey project.

2. Scope and Objectives

2.1 Scope and Limitations

The project focuses on the inbred rice seed value chain particularly on the supply chain at Nueva Ecija (PhilRice Central Experiment Station) and Isabela (PhilRice Isabela branch station in Northeastern Luzon). The hybrid rice seed value chain was not included in this study.

2.2 Objectives

Generally, this research aimed to evaluate the value chain of the inbred rice seed industry to support the enhancement of the Philippines' national rice program.

Specifically, it aimed to:

1) Review the long- and short-term agricultural policies on rice seed value chain;
2) Collect necessary data of the rice seed value chain to facilitate the analysis of the situations and circumstances in the Philippines; and
3) Formulate practical recommendations relating to rice seed production and distribution system in the Philippines.

2.3 Duration

The project was implemented for a period of five (5) months, covering July-November 2019.

3. Methodology and Framework

3.1 Preface and Conceptual Framework

The conceptual framework of this study was based on the approaches used in agricultural sector encompassing the activities from production (acquisition of seed materials) to postproduction activities with emphasis on warehousing and storage, then at marketing or distribution and post-distribution phase.

At production, only the acquisition of seed materials was highlighted as part and parcel of the value chain analysis. All the activities under the postproduction, marketing/distribution and post-distribution are to be included in the study. The players of the rice seed industry were tapped as respondents or key informants either during consultation meeting, focus group discussion (FGD), key informant interview, and observation. Relevant government policies, rules and regulations pertaining to rice seeds were also reviewed as to their relevance and further enhancements. Figure 1 shows the interrelatedness of the activities and the players alongside with the government policies and rules and regulations anchoring the rice seed industry.

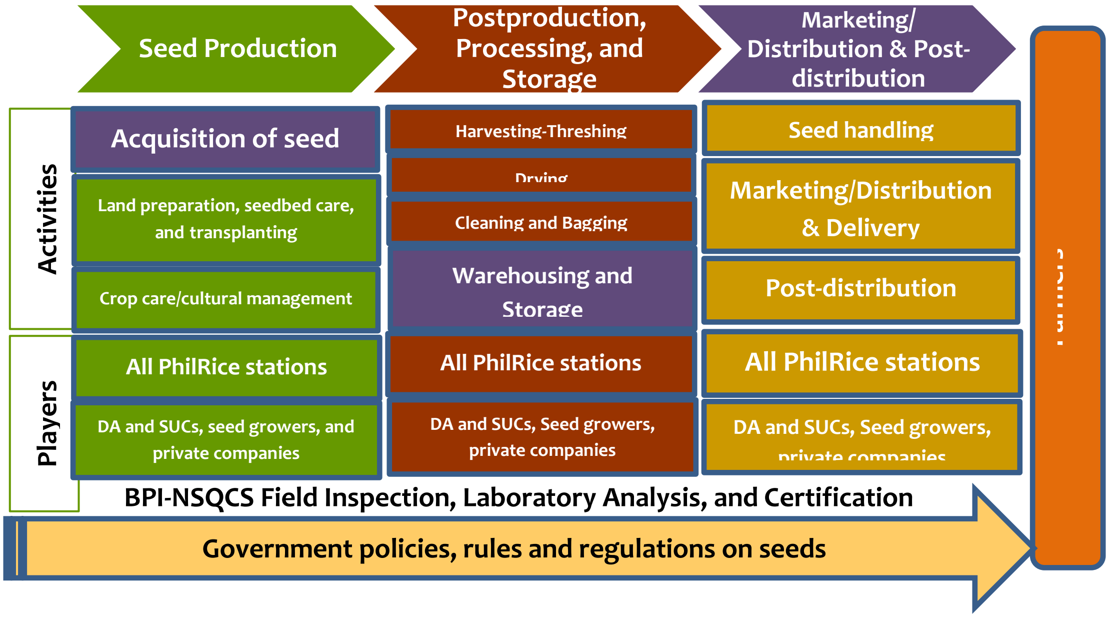

Figure 1. The conceptual framework of the joint research.

3.2 Methodology

The study was conducted in three stages, namely: 1) table research/ study; 2) field survey; and 3) data/information analysis and reporting. These three stages provided basis for the total picture of the rice seed value chain which contribute to the sustainability of the source of high-quality seeds for distribution.

The field survey involved an FGD among seed producers in selected town(s) of Nueva Ecija and Isabela. Twenty seed growers of Nueva Ecija were invited during the FGD. Two batches of FGD was conducted in Isabela. The first batch of FGD involved 10 Board of Directors of the Isabela Seed Growers Multi-Purpose Cooperative (ISGMPC), the assistant head of Bureau of Plant Industry-National Seed Quality and Control Services (BPI-NSQCS) and three other SGs from Cagayan and Isabela. This first batch of FGD was facilitated by the Korea Rural Economic Institute (KREI) officials and PhilRice CES Business Development Staff with the help of the BPI-NSQCS. The second batch of FGD was conducted involving 30 members of the ISGMPC and 30 members of the San Manuel Seed Growers Multi-Purpose Cooperative (SMSGMPC).

Rice Production and Distribution Status and Enabling Laws in the Philippines

Chapter 2

1. Rice Production and Distribution Status

The Philippines harvests rice from a total of 4.8 million ha annually, of which about 3.2 million hectares (ha) are produced from irrigated areas and the remaining are from non-irrigated or rainfed areas (PSA, 2018). In terms of average yield, the Philippines' performance is at the lower segment among its ASEAN comparators, with annual production per hectare at 9.52 tons per ha, with average yield of 5.68 tons per ha during high-yielding season, and 3.84 tons per ha during low-yielding season (Bordey, et al. 2016). In terms of average yield by ecosystems, irrigated areas achieve 4.37 tons per ha, while non-irrigated or rainfed areas average at 3.12 tons per ha (PSA, 2018). During low-yielding season, harvest volume dips due to typhoon occurrences where sustained floods damage rice crops. In fact, the devastating effects of extreme weather conditions due to climate change has called the attention of the DA and have this issue addressed as one of the three major targets in the Philippine Rice Industry Roadmap 2030, which includes: *1) improved competitiveness, 2) enhanced resiliency to disasters and climate risks, and 3) ensured access to safe and nutritious rice*.

The Philippines has an average rice sufficiency level of 93.2% for the last five years (2013-2017 PSA data), which necessitates a certain level of rice importation from its neighboring rice-producing countries like Thailand and Vietnam (Annex 1). However, despite the industry's efforts to achieve rice self-sufficiency, the steady increase in population and increasing per capita consumption, makes narrowing the supply-demand gap a challenging task for both the private and government sectors. Per capita consumption rose from 107.83 kilograms (kg) per year or 295.43 grams per day in 2016 to 118.25 kg or 323.97 grams per day in 2017 (PSA) as shown in Annex 2.

Aside from being one of the countries with high to moderate vulnerability to climate change effects such as typhoons, drought and flood, the Philippines still has low level of mechanization, with majority of mechanization intervention in land preparation (plowing and harrowing) and threshing activities. In a joint study by Philippine Center for Post-Harvest Development and Mechanization (PhilMech) and PhilRice (2016) regarding postharvest loss assessment, it was found that an average of 14.29% grain loss can be attributed from postharvest operations (from drying to storage). Moreover, harvesting, threshing and drying activities comprise 57% of the total share in postharvest activities, and that about 8.15% of post-harvest losses are caused by inefficiencies and inadequacies in harvesting, threshing, and drying activities.

Rice production remain labor-intensive despite contributing a significant chunk to the country's Gross Value Added (GVA) together with other agricultural crops. Aside from the steep price of acquiring new farm machinery, the practicality of such investment is not as feasible since majority of Filipino farmers' average landholding is only about 2 ha. Some progressive farmers have found means to alleviate their situation by organizing themselves into farmers' cooperatives or associations in order to have access to capital thru credit, custom service operations (land preparation and harvesting), and wider access to marketing and distribution channels. Membership to cooperatives also provide farmers with higher engagement with government projects and extension services (trainings) thru the DA.

2. The Formal and Informal Seed Systems, and the Enabling Laws of the Philippine Rice Seed Industry

The Formal and Informal Rice Seed Systems

The rice seed system is composed of the formal and informal seed systems. In a formal seed system, rice seed varieties are developed, produced, and transferred from one channel to another following government procedures on variety development, approval, certification, release and distribution until it reaches the farmers. In contrast, informal seed systems do not have a well-structured channel as to where seeds should be distributed, as the system encourages seed exchange among and between farmers from their own harvest. Since the informal seed system does not undergo any regulatory process, issues on low germination and purity are the problems farmers face when accessing seed thru this system. The enduring presence of the informal seed system is a result of the farmers' difficulty in accessing high-quality seeds, which is reflected in the level of adoption of high-quality seeds among farmers in different areas of the country.

Taking off from the context of formal and informal seed systems, Figure 2 shows the synergistic approach of how each of the players interact and contribute to the rice seed industry.

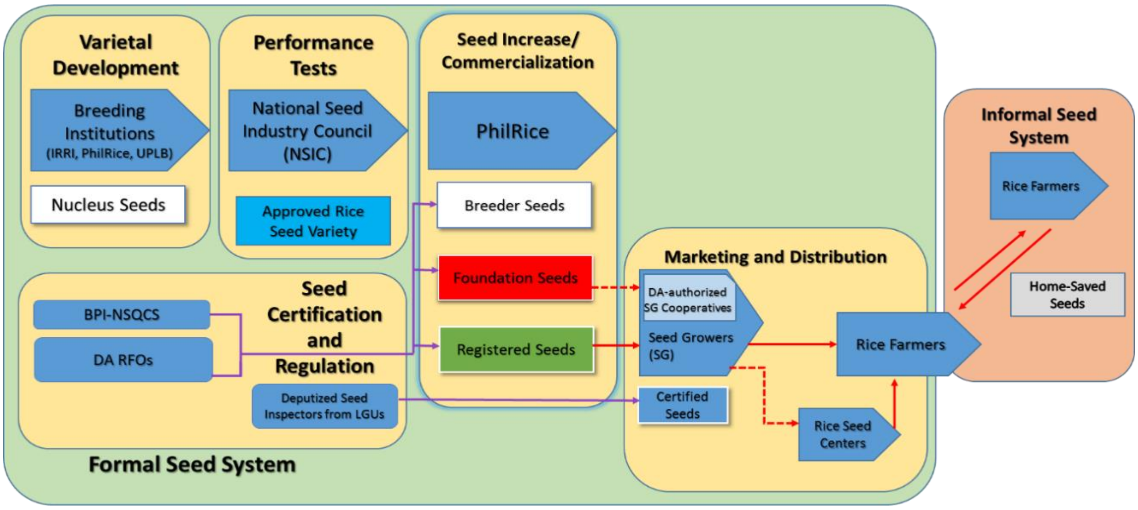

Figure 2. Formal and Informal Rice Seed Systems

The Republic Act (RA) No. 7308

With rice, being the main staple crop of the country, the government exercises a level of control over the rice seed industry thru various laws, policies and regulations. One of the main governing laws crafted by the government is the RA No. 7308 or otherwise known as the Seed Industry Development Act (SIDA) of 1992 which aims to *promote and accelerate the development of the Philippine seed industry through the creation of the National Seed Industry Council (NSIC) to formulate policies, encourage persons to engage in the industry, promote the establishment of infrastructures and other support services needed towards the development of the seed industry, among others*. Through this act, the government shall support the Philippine seed industry through:

a. conservation, preservation and development of the plant genetic resources of the nation;
b. organization of all sectors engaged in the industry, integrate all their activities, and provision of assistance to them;
c. prioritization of the seed industry as a preferred area of investment;
d. partnership with private sector to engage in seed research and development and in mass production and distribution of good quality seeds; and
e. protection of the local seed industry against unfair competition from imported seeds.

This is the very basic law enacted for the seed system and its implementing rules and regulations (IRR) provides for specific duties, powers, and functions of the NSIC along with the technical working groups (TWGs) and agencies involved in the seed industry development program.

The NSIC is chaired and co-chaired by the Agriculture Secretary and Bureau of Plant Industry (BPI) Director, respectively, with members coming from other agencies such as PhilRice, Dean of the College of Agriculture and Director of Institute of Plant Breeding both at the University of the Philippines (UPLB), the Crops Research Director of the Philippine Council for Agriculture, Aquaculture, and Natural Resources Research and Development (PCAARRD), and two representatives from accredited farmers' organizations and one representative from the Philippine seed industry. Supporting DA, BPI Director also co-leads the NSIC and has the main function of evaluating and recommending promising entries as approved rice varieties for commercial cultivation.

Along with the creation of NSIC, the NSQCS was also constituted in the BPI to control and supervise over field inspection, certification and seed control services, and seed testing laboratories. It is the regulatory agency of the rice seed system. It has the sole mandate of performing the seed quality analysis which is the basis for the certification of seeds. It formulates plans and programs on seed quality control services and activities pertaining to seed testing, certification, and other quality control schemes. It accredits the seed producers through criteria and training.

The law also provides for regional and provincial linkages by specifying the functions of the regional seed coordinators (RSCs), provincial seed coordinators (PSCs), and seed inspectors (SIs). Although the latter two actors are devolved to the local government units (LGUs), their designations and assignments for the seed program in the regions and provinces are issued by the Secretary of Agriculture upon recommendation by the BPI Director with the concurrence of the DA Regional Executive Directors.

The DA Administrative Order (AO) No. 6-95 was issued on February 27, 1995 with some provisions of the IRR that were revised. TWGs were revised/renamed and/or added to include medicinal into ornamental varietal improvement group (VIG), tobacco VIG instead of crop VIG, fusion of the Seed Monitoring and Marketing Information and Seed Extension Groups into Seed Extension, Promotion, and Marketing Group, and the Seed Production, Processing, Storage, and Distribution Group.

Other policies on seed system pertain to guidelines on seed certification, accreditation of seed producers, buying and selling of seeds, provision of agricultural and postharvest equipment and facilities which were basically issued through DA AOs. Titles of these policies are shown in Annex 3.

This law was enacted on March 27, 1992 and its IRR was issued on April 7, 1994. There was a lag time in the formulation of the IRR from the enactment of the law. The seed industry development program was seemingly drafted but not officially launched and implemented. Hence, the development of the seed industry took its course in a long way.

The functionality of the created offices (NSIC and its TWGs, and NSQCS) and its linkage to the DA-Regional Field Offices (DA-RFOs) and other agencies is hardly been enforced as is though it slowly took off to where it is now. The roles of the RSCs and PSCs are very critical because they provide coordination and linkage from the bottom to the top.

The Philippine Rice Liberalization Law (RA. No. 11203) and its provisions

This law is otherwise known as an "Act Liberalizing the Importation, Exportation and Trading of Rice, Lifting for the Purpose the Quantitative Import Restriction on Rice, and for Other Purposes". With this law, the Rice Competitiveness Enhancement Fund (RCEF) seed component program, provides an avenue for the inbred CS to be procured by PhilRice from seed growers and be distributed for free to farmers. It aims to complement and supplement relevant interventions to achieve the targets set in the Philippine Rice Industry Roadmap (PRIR). Its seed component intends to improve the yield in rice-producing provinces through adoption of inbred seeds. Through it, PhilRice shall allocate the Rice Fund-seed component to the following: **(i) Research and development; (ii) Propagation of nucleus, breeder, foundation, registered, and certified seeds; (iii) Promotion and distribution of seeds and associated crop management technology;** and other similar activities necessary to implement the program.

Among the provisions of this law is the training and extension component, credit and finance, and mechanization with the latter that got the highest budget allocation. On training and extension, PhilRice also plays a very crucial role along with the facilitating agency, the Agricultural Training Institute (ATI) and the Technical Education and Skills Development Authority (TESDA). These provisions complete the support and services for the whole rice value chain.

3. The Philippine Rice Seed Industry Players and the Rice Seed Classes

RA No. 7308 also gave PhilRice the mandate *"to develop appropriate rice varieties suited under Philippine conditions, propagate these into breeder, foundation, and registered seeds, and extend all necessary technical assistance to ensure the proper utilization of such seeds on the farm level"*.

Aside from PhilRice, the rice seed industry in the Philippines is participated in by several government agencies and private sector groups, with involvement on plant breeding, seed production, seed processing (harvest, post-harvest, and storage), marketing and distribution, and regulatory processes as shown in Table 1.

Table 1. Roles and functions of seed industry players.

PROCESS	INDUSTRY PLAYER	FUNCTION
Research and Development		
Rice Breeding and Varietal Improvement	PhilRice	• conserve and preserve rice genetic resources • develop appropriate rice varieties suited under Philippine conditions
Performance Testing and Evaluation		
Testing and Evaluation of Potential Rice Varieties	National Seed Industry Council	• thru the National Cooperative Test (NCT), conducts yield trials of promising rice lines in several locations representing different ecosystems to determine the relative merits of these lines to become varieties
Seed Production/Multiplication and Commercialization		
Seed Production / Multiplication of Higher Seed Classes – Breeder, Foundation, and Registered Seeds (BS, FS, and RS)	PhilRice	• produce basic, breeder, and foundation; and registered seeds • extend necessary technical assistance to ensure the proper utilization of such seeds on the farm level
Marketing and Distribution		
Certified Seed (CS) Production	Individual Seed Growers (SGs) and Cooperatives	• produce, market, and distribute certified seeds to rice farmers
Quality Certification and Regulation		
Seed Quality Certification	Bureau of Plant Industry (BPI)-NSQCS	• formulate plans and programs on seed quality control services and activities on seed testing, seed material certification and other quality control schemes to be developed • samples and conducts seed analysis based on certification standards, and issues the corresponding report of analysis • conducts field inspections, seed storage and processing facilities, and other activities required for seed certification and issue the

PROCESS	INDUSTRY PLAYER	FUNCTION
		corresponding report of inspection
	Deputized seed inspectors from Local Government Units (LGU)	• conduct field inspections and seed sampling in their areas of assignment, following the prescribed standards set by BPI-NSQCS required for seed certification • prepare and submit applications for certification, and reports of inspection to BPI-NSQCS
	DA-RFOs	• oversees implementation of the rice program and protocol imposed by BPI-NQCS to seed producers • determines the seed demand and supply in their regions, and coordinates with other DA RFOs and agencies, and SGs in ensuring adequate supply of buffer stocks of seeds

Inherent to the creation of the BPI-NSQCS per RA No. 7308, it plays a very vital role in ensuring the SGs' credibility and certifying the quality of seeds thereby signals the availability and accessibility of seeds aside from quality at the time of need. Along with other functions, it provides training of prospective seed producers (SPs) as a primary requisite for accreditation to seed produce. Those entities and individuals involved in the seed production undergo training on cultural management, harvest and postharvest management and activities, and the necessary process of field inspection, seed sampling, testing and analysis, and certification.

The individual SGs receive their certification of training and accreditation from the BPI-NSQCS upon completion of the required training and complying with other requirements of seed growing such as proof of ownership or leasehold for the area intended for the purpose, and facilities in harvest and postharvest operations. Standard criteria for the requirements were already established by BPI-NSQCS.

Volume setting of the total seed demand and coordination with LGUs and SG cooperatives are the roles DA-RFOs play in the rice seed system. Thru their RSCs, each region assesses the requirements of each province under their coverage. This is done in concurrence with the PSCs which are governed by LGUs. The PSCs provide information about the total rice production area, seed requirement, and initially identify possible sources of CS from SG cooperatives operating in their area.

Deputized seed inspectors (SIs) serve as direct link of BPI to individual SGs as they are the ones who conduct the field inspection and monitoring of the seed production areas. They are also in-charge of filing the application for seed certification of individual SGs, providing the initial screening and checking accuracy of information provided by the applicant-seed grower. In the field inspection and seed sampling, the SIs also play critical role. The SIs, however, are personnel at the LGUs and not organic BPI-NSQCS staff. This organizational set up creates vacuum and misaligned activities owing to two separate agencies providing orders and reportorial requirements to SIs. As such, some concerns are being raised and still pending solutions.

The SGs and cooperatives are important players in the rice seed industry. They are the extension arm to the farmers for the production and distribution of CS.

Rice seeds are also categorized based on its seed classes, namely: 1) nucleus (basic); 2) breeder (BS); 3) foundation (FS); 4) registered (RS); and CS. These seed classes have designated producers or supply source among the different industry players. Table 2 shows the delineation of seed classes and their corresponding producer or seed source.

Table 2. Inbred rice seed producers according to seed class.

Seed Source	Rice Seed Classes			
	BS	FS	RS	CS
PhilRice				
Other breeding institutions (IRRI, UPLB)				
Seed Producers*				

* DA-RFOs, State Universities and Colleges (SUCs), SGs, and SG Cooperatives

4. Other Component Activities of the Rice Seed Value Chain

a. Seed Production

Planning for seed production for specific season involves deciding in advance, ie., at least 1-2 months for area, timing, selection of varieties for seed production and seed sourcing, laborer assignment, and putting a blueprint of the planting plan for ready reference before the onset of the season. The sourcing or acquisition of seeds is seen crucial because this is the very basic foundation of the seed production operations/activities. PhilRice as seed source in the value chain plays a vital role in making these available anytime for SPs' (DA RFO Seed Centers, SUCs, seed growers and cooperatives) needs.

Production of high-quality seeds is almost similar to the process followed in commercial rice production. The main difference is that production of high-quality seeds (BS, FS, RS and CS) undergo regulatory procedures implemented by the government thru the BPI-NSQCS. This means that the seeds produced are required to undergo laboratory analysis in order to secure a seed tag, as proof of quality certification.

While there is still no limitation imposed as to the number of seed growers per province, all potential seed growers should comply with all the requirements set by BPI-NSQCS in order to be accredited and allowed to produce and market certified seeds. Aside from the documentary requirements, the seed production areas are inspected, including owned facilities, and should undergo specialized seed production training prior to application for accreditation. Those already accredited, their renewal is subject to their compliance to the eligibility criteria.

All the SPs have their own plans for their seed production with which acquisition of seeds is a primary consideration. These players are dependent to PhilRice for their planting materials, either FS or RS. Their acquisition of seeds triggers PhilRice to be more proactive and responsive as source of higher seed classes as it shall ensure the availability of the seeds at all times.

b. Postproduction, Processing, and Storage

Under the postproduction, harvest and postharvest (processing) operations are done thru the use of machines/equipment from harvesting (manually or combine harvesting), threshing, hauling from field and weighing, loading and drying, cleaning and sorting, and weighing and bagging.

Care is also taken in drying seeds to the prescribed moisture content of 12-13% MC. In the Philippines, seed growers use either mechanical dryers or solar drying in pavements. Solar drying, though cheaper, still incurs cost as the task is labor-intensive and seed growers hire laborers on a per unit basis. Although more expensive, use of mechanical dryers (flatbed and reversible dryers) provide lower probability of physical contamination (weed seeds, stones, and other impurities) which highly affects physical purity resulting to downgrading or rejection. During the wet season, use of mechanical dryers is even more necessary as freshly harvested seed have higher moisture content (MC) compared to the dry season harvest. Dried seeds undergo additional processing activities, such as seed cleaning and sorting, to ensure its physical purity. After seed processing, storage and warehouse management are critical aspects as conditions surrounding these have direct effect on seed quality and germination.

The quality of seeds also depends largely on the seed viability in expressing its physiological and productivity potential. The viability of the seeds spells out its quality from production to postproduction, and is highly affected at warehousing and storage when biotic (bacteria, insect, fungi, and viruses) co-occur with abiotic factors (temperature, humidity, and moisture content or MC) at favorable condition. At warehouse and storage, rice seeds need to be maintained at appropriate temperature and MC to preserve their quality. Seeds need to be protected from damage by insects and other pests, such as rodents and birds as they promote growth of microorganisms which cause spoilage and affect seed quality.

Warehousing and Storage Management. At the time the seeds are processed, warehousing is an important aspect that should be looked into. This includes planning for the warehouse and stock management, stocking and managing rice seeds which includes retesting the germination of stored seeds, maintaining warehouse upkeep and storage pest management, and disposal of low germination seeds.

During storage, the viability of the seeds is greatly affected by coexistence of both abiotic and biotic factors. It is critical that the facilities are fit and functional for use to ensure the quality of seeds at every stage, process, and place. With climate change, the current condition of the PhilRice seed warehouses faces many challenges and more problems rather develop. These facilities are suitable only for temporary (2-3 months) storage and quite different from the recommended ones for relatively longer period of storage. Erratic temperature and humidity often make seeds more prone to deterioration. At high temperature and RH, seeds reach high equilibrium MC favoring deterioration or loss of vigor and vitality. High MC creates a favorable condition for the seeds to fissure and insect pests to multiply and severely infest the stored seeds. The loss of seed viability is a natural phenomenon and viability decreases even under the optimum storage and temperature conditions (Kapoor *et al.*, 2010; Hartmann Filho *et al.*, 2016). Having this situation and condition of storage facilities, addressing the needs for high-quality seeds become challenging much so that the enactment of the rice liberalization law specifies PhilRice to distribute CS to farmers. This law expands PhilRice's mandate not only for the production of higher seed classes, leaving PhilRice with no other choice but to slowly enhance its institutional capability to be able to meet the demands of higher to lower seed classes and distribute the lower seed classes to farmers.

Warehousing and storage are equally and interchangeably important activities as other subsequent activities both internally and externally rely much on the viability of the seeds. The internal operation at PhilRice demands for proper handling of seed inventory and storage management where both abiotic and biotic stresses are encountered. The external operation entails activities such as seed testing, analysis, and certification which are done by the BPI-NSQCS. The BPI-NSQCS designated and deputized SIs are responsible in drawing out samples from the seed lot. The seed samples are brought to the laboratory for seed testing, analysis, and certification based on the progeny of the seeds.

c. *Marketing, Distribution, and Delivery*

This covers seed handling, marketing, distribution or selling, and delivery of high-quality seeds to various SPs which include accredited SGs, cooperatives, DA-RFOs and seed centers, and SUCs. Figures 3 and 4 explicitly provided an overview on the distribution of higher to lower seed classes up to commercial rice.

At the time that the seeds are already certified and tagged per seed class, the interface of the warehousing and storage management, handling, and marketing come in. A synchrony of the data/information should always be achieved to avoid misappropriations in distribution. With the challenges of the RCEF-Seed Component Program, handling of these higher seed classes vis-à-vis contracted seed growers' cooperatives and the targeted beneficiaries of CS is very crucial to be intertwined together to achieve best results.

Price of Seeds

Selling price of inbred seeds is prescribed by the government thru DA which is facilitated by BPI. The prescribed rates are reviewed as deemed appropriate considering inflation and market forces. The latest issuance of the rates was the Department Circular No. 15 Series of 2018 issued by the DA, "Amending the Buying and Selling Prices of Inbred Rice Seeds" as shown in Table 3.

Table 3. Current selling price of inbred seeds.

Seed Class	Price per Kilogram (Php)	Price per Bag (Php)	Packaging Size (kg per bag)
Breeder	250	1,250	5
Foundation	88	880	10 and 20
Registered	46	920	20 and 40
Certified	38	1520	40

Source: DA Administrative Order

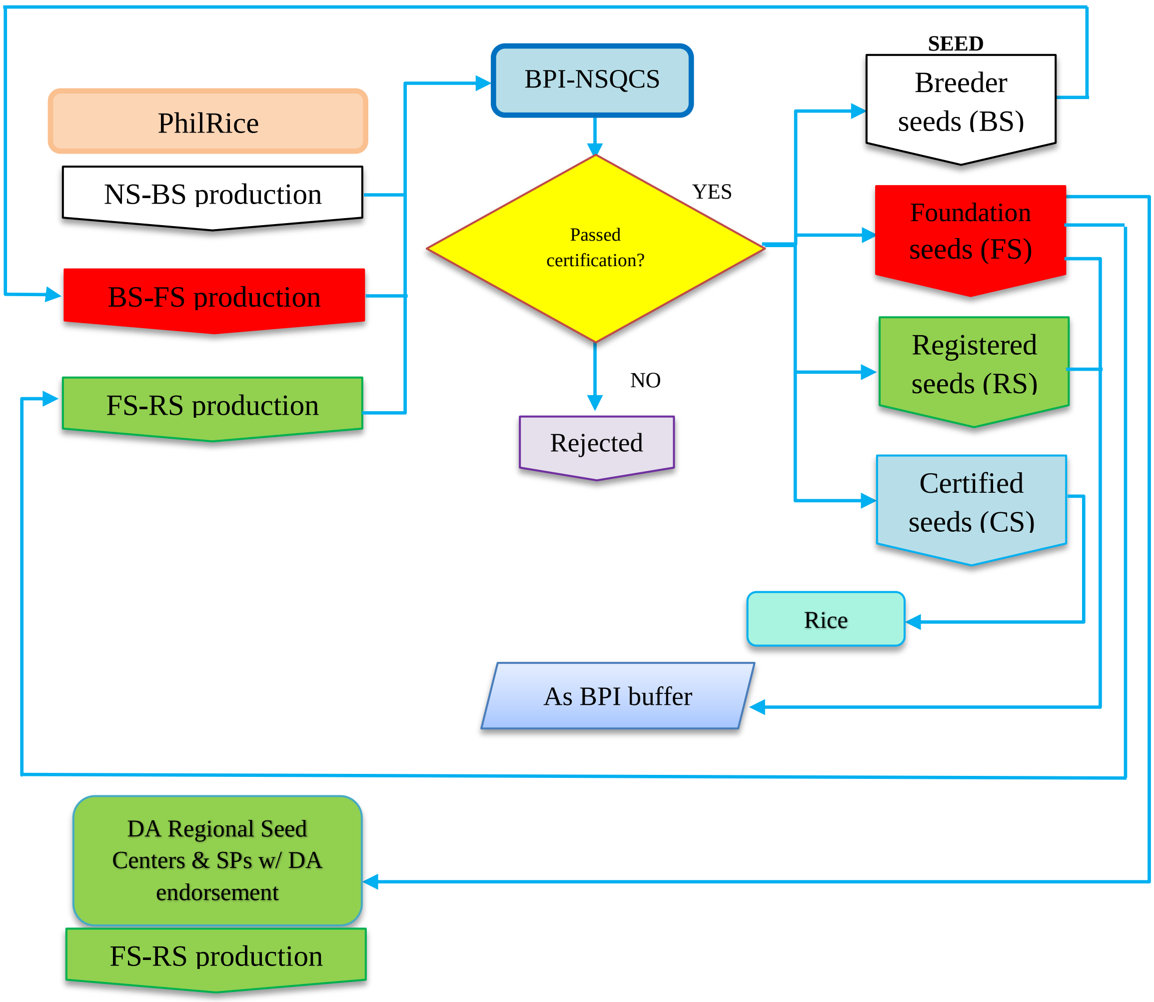

Figure 3. Higher seed classes production-distribution flow from PhilRice to SPs.

Source: Bongat, FP, et al. Final Report on Philippine DA-BAR-funded project on Documentation and Assessment of Central Luzon's Rice Seed Information System (RSIS)

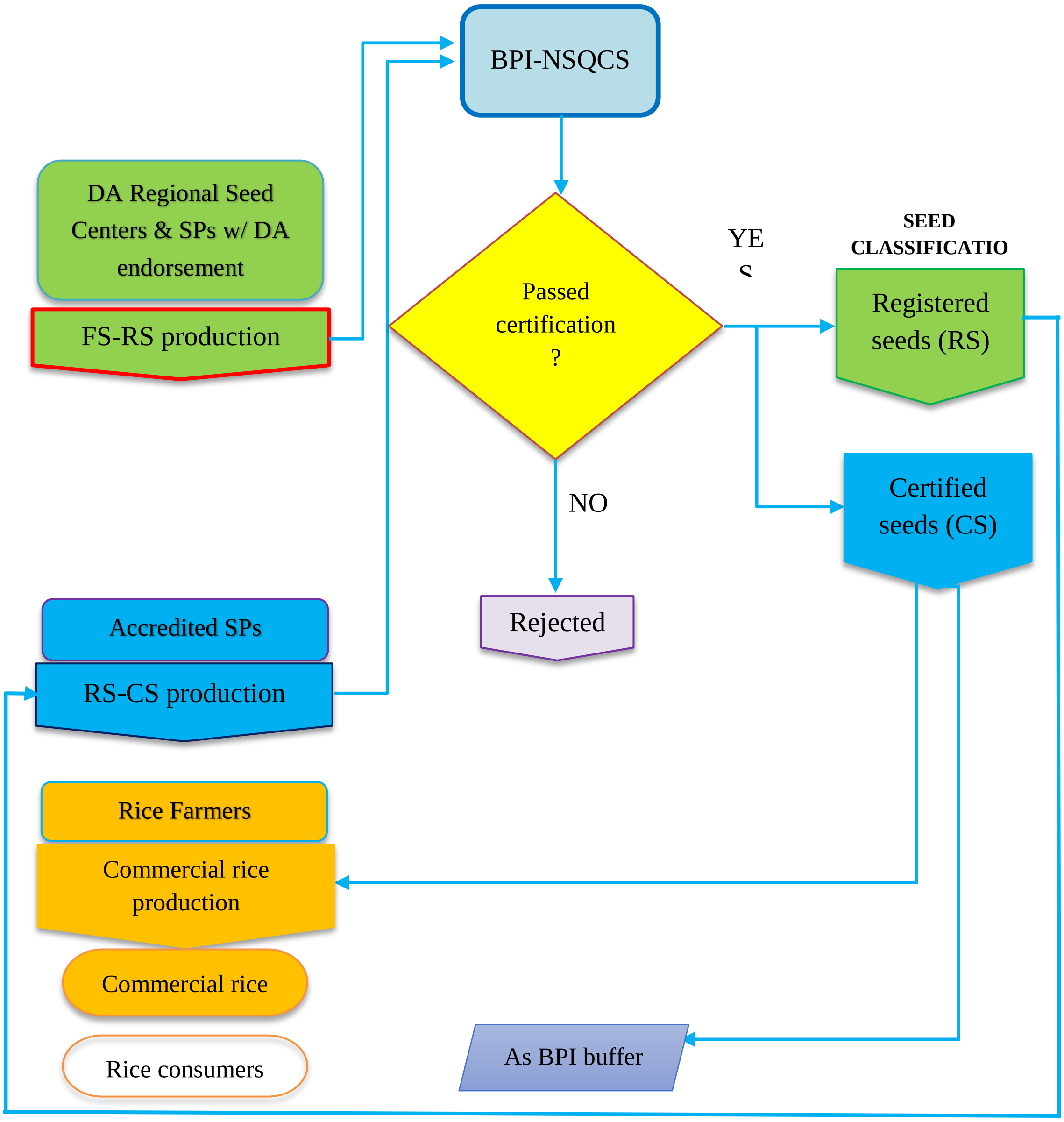

Figure 4. RS-CS-commercial rice production and distribution flow.

Source: Bongat, FP, et al. Final Report on DA-BAR-funded project on Documentation and Assessment of Central Luzon's Rice Seed Information System (RSIS)

d. Post-Distribution Customer Engagement

Farmers as customers are vital to a continuing and progressive rice seed industry. Generally, SPs/Gs have their own way of reaching out to their customers either first-timers or already repeaters. For PhilRice, it has a database of its customers alongside with the list of SGs and cooperatives. It engages with them thru the DA-

RFOs, meetings, emails, phone calls, and face-to-face encounters. Both the SPs/SGs and PhilRice, engage their customers thru constant text messaging, calls, and representations to meetings, to government agencies especially DA-RFOs, and even LGUs.

e. Technology and Innovations

Along the rice seed value chain, the SPs/SGs were asked what other technologies and innovations especially in the production, harvest, and postharvest operations do they need or what technological interventions are yet needed. PhilRice has generated and continuously generating technologies on rice seed production, from land preparation, cultural crop management, harvesting, and post production which were already been disseminated to them and/or being validated with them. The current issue on the use of machines in crop establishment and in harvesting per results of research is still put on hold pending on the preparation of the guidelines and approval of the Agriculture Secretary thru the BPI-NSQCS and NSIC TWG on Seed Production, Storage, and Distribution.

Technologies on rice seed production generated from research and development (R&D) conducted by PhilRice and even the International Rice Research Institute (IRRI) are extended through trainings, demonstration, and as knowledge products such as technology bulletins, brochures, flyers, videos, among other forms. Trainings are facilitated by the ATI.

f. Linkages and Access to Information

Support mechanisms are very important in the rice seed business, hence, linkages between and among the rice seed industry players are needed. The SPs/SGs are linking with their members through their general assemblies, board of directors' meetings, and individual members visit to their offices, or through phone calls or text messages. Among cooperatives, they link and access information thru the federation meetings and cascaded them to individual cooperatives. The social media such as Facebook and Twitter had been avenues to connect and access information of all sorts.

The use of social media is now a hardcore source of information among the players of the rice seed industry – the support and coordination sub-system or agencies implementing production and regulation, the SGs and farmers, and those individuals with interest in venturing rice production. Taking all the advancements in information and communications technology (ICT), linking and accessing information from all sorts is now easier and transforming agriculture sector into the modern digital agriculture to further improve social and economic benefits (Singh, et.al., 2017) is a trend worldwide. Through ICT, a two-way process of communication and information dissemination become a must. It helps integrate the whole agribusiness system.

g. Opportunities and Bottlenecks of the Rice Seed Industry

Opportunities. With the enactment of the RA No. 11203, many opportunities were seen for the whole rice seed value chain, most especially benefitting the SGs. The opportunities that are likely true to all is the strong support for inbred rice seeds rather than the hybrid. From this, the breeders of PhilRice and IRRI may take this a challenge to develop new plant type that would bring forth high-yielding varieties that can compete with hybrids. Another opportunity is the engagement of individual and cooperatives of SGs that are likely all-Filipino and not multi-national corporations. The cooperatives of SGs are now being contracted by PhilRice to produce the CS requirement for the RCEF-Seed Program Component. The engagement of these SPs would help boost the economic outlook of the country. Also, revival of the formal rice seed industry is likely to happen with this law.

Bottlenecks. The rice seed industry is taking so long to correct some erring SPs and illegal SGs because of the absence of police power of BPI as a regulatory agency tasked to do the seed quality control. This is one of the bottlenecks that needs attention and promulgation. The long wait to the results of seed testing, analysis, and certification owing to low absorptive capacity of the BPI-NSQCS as brought by only few people undertaking such testing, analysis, and certification is still a big concern especially that seed samples are submitted all at the same time.

Selling/usage of untagged seeds. One of the bottlenecks of the industry as identified by the SGs is the selling of untagged seeds in the market. These untagged seeds are good seeds that did not undergo the NSQCS certification, inspections, testing, analysis, and other standards and protocol, thus, these are illegal. They just produce fake tags and sacks and they even sell the seeds on a lower price than the prevailing or prescribed rates, causing other farmers, who did not know that the seeds they are buying are illegal, to patronize in using untagged seeds. To prevent this, SGs recommended to educate farmers on how to double check if the seeds they purchase are tagged or not. It was also recommended by the SGs themselves that BPI-NSQCS should strengthen the security feature/authenticity of tags, and if possible, control the production and distribution of blue bags.

On the other hand, however, according to the SGs themselves, not all untagged seeds are good seeds – some are CS but without tag. These seeds had undergone all seed sampling, analysis, and certification standards and protocol. However, because of the BPI-NSQCS policy that limits a certain number of bags to be tagged in every hectare, the excess produce is labeled as untagged seeds. Also, when farmers are already in need of seeds, they buy the seeds even though the results of seed analysis and certification are not yet finished and issued to the SGs. Most of the time, the SGs dispose their seeds even without the tags because their customers are already buying. Because of long relations they have established and nurtured, the untagged seeds coming from the accredited SGs with most likely quality seeds are sold in the same manner as those untagged seeds that are not subjected to field inspection and certification. Distinguishing the untagged seeds whether belonging to the seed lots with or without certification may hardly be done. In any case, this bottleneck of the rice seed industry is quite a challenge that needs solutions and mitigation to abate effects and repercussions. The BPI-NSQCS as a regulatory body may be enforced with so much power to impose sanctions to erring SPs/SGs.

Results and Discussion on the Cases of Isabela and Nueva Ecija

Chapter 3

1. The Cases of Isabela and Nueva Ecija Rice Seed Value Chain

Current Situation of Isabela and Nueva Ecija

Isabela province is located in the northeastern part of Luzon. It comprises an aggregate land area of 12,414.93 km^2 and is the second highest rice-producing province in the country. It produces 15% of the aggregate national rice production on annual basis. Being a surplus producer of the Filipinos' staple crop, the province's rice sufficiency rate is at 224%, which means that it produces more than it consumes and is in fact responsible for supplying the rice requirements of Metro Manila and many other provinces (Wikipedia).

On the other, Nueva Ecija is located at the heart of Central Luzon or Region 3 of the Philippines. It is the largest province covering a total area of 5,751.33 km2 (2,220.60 mi^2). It is the major rice-producing of the country and holds the title rice granary of the country as it consistently posts the highest average yield among the provinces.

In 2017, estimated level of adoption of high-quality (CS) in Isabela and Nueva Ecija is almost similar at 79% and 78%, respectively. However, there is still 13% of non-adopters of high-quality seeds in Isabela compared to 1% in Nueva Ecija, the rest of the farmers plant hybrid rice (DA PRIR 2030, 2018). As demand for high-quality seeds is relatively high in these provinces, majority of farmers buy seeds via the formal seed system.

Status of seed growers (SGs)

The Isabela and Nueva Ecija SGs source mainly their FS and RS from PhilRice. For some instances, RS may come from DA-RFO seed centers, BPI (from the reserve or buffer stocks), SUCs, and their fellow SGs who were given special endorsement/accreditation to plant FS. Isabela has 242 accredited SGs affiliated in seven cooperatives with total accredited seed production area of 1903 ha (Table 4) while Nueva Ecija has 518 accredited SGs affiliated in three cooperatives with 3,658 ha seed production area (Table 5). These SGs constitute the majority of the SGs nationwide and mostly the suppliers of the CS reserve stock of the DA-RFOs.

Table 4. Number of SGs, SGs-cooperatives, and total accredited area in Region 2.

Info	Provinces			
	Isabela	Nueva Vizcaya	Quirino	Cagayan
No. of coops	7	1	1	2
No. of SGs	242	8	10	190
Total accredited area (ha)	1,903	29.81	33.50	1,207.80

Source: BPI-NSQCS Region 2

Table 5. Number of SGs, SGs-cooperatives, and total accredited area in Region 3.

Info	Provinces				
	Bataan	Bulacan	Nueva Ecija	Pampanga	Tarlac
No. of coops	1	1	3	1	1
No. of SGs	10	39	518	31	17
Total accredited area (ha)	103.9	285.4	3,658.0	445.6	209.5

Source: BPI-NSQCS Region 3

Current Status of Logistics, Market Access, and Information

a. Logistics and Infrastructure

In seed production, farm facilities are important in the reduction of post-harvest losses. That is why one of the requisites before being accredited as an SG is to have a drying facility, either personally owned or thru the cooperative where an SG is a member. SG cooperatives also invest on seed processing, farm equipment, trucks for transport of seeds, and warehouse facilities. Similar to farmer cooperatives, formation of and memberships to SG cooperatives are one of the strategies seed growers do to improve their overall business efficiency and reduce cost. However, a few SGs have expressed their need to replace or upgrade their post-harvest facilities and equipment as the existing ones are already depreciated and needing costly maintenance.

On logistics, transport of seeds by land from Isabela going to other provinces southbound is a challenging task as the roads, though paved, are winding with steep elevations and ravines. Travelling by land will take a truck several hours (about 8-12 hours) going to Metro Manila and to major destinations.

b. *Market Access and Information*

In terms of access to market information, face-to-face interactions during meetings as well as use of mobile communication (calls, SMS) are still the most common means of conveying information. The SG cooperatives conduct regular monthly meetings in order to update their members with the status of their target volume to be supplied, and anticipate the volume to be turned over by their fellow members. These meetings are documented with a designated secretariat taking the minutes of meeting and compiling them for future reference.

The government also extends information about the latest technologies on rice thru its extension agency (Agricultural training Institute or ATI) activities, ie., seed production trainings, science and technology (S&T) updates, technology demonstrations, and farmer’s field day. Farmers are also tapped by PhilRice during pre-commercialization of developed farm machines and diagnostic tools in order to gather their initial feedback about the prototype. During these activities, PhilRice as well as the farmers and SGs are able to mutually gain information from each other being both players in the rice seed industry.

Aside from the conventional form of accessing information, ICT has also found its way in agriculture in the form of mobile applications and social media platforms such as Facebook and Twitter. PhilRice, aside from maintaining its institutional web page, also utilizes social media platforms like Facebook and Twitter to expand customer coverage. The wider customer reach enables PhilRice to interact with their customers removing any geographical boundaries that may have exist prior to Facebook and Twitter. Latest technology updates and video demonstration about *PalayCheck* and other technologies are uploaded in the web for public consumption. Mobile applications developed by PhilRice such as *Binhing Palay* provide information on seed variety characteristics and yield performance to help farmers choose the appropriate variety for his location. The *MOET app* is a diagnostic tool which provides site-specific nutrient recommendation on rice. These mobile apps aim to provide farmers, SGs, and other rice stakeholders with the means to provide information and technologies on rice wherever and whenever it is needed. However, the main issue on using such mobile applications is the internet access, especially in remote areas. Nevertheless, these are alternative options provided by PhilRice to rice stakeholders.

According to them, SGs wish to access information such as updates if the SG’s accreditation is still accredited or already expired; information on how much is acquired, sold, and remaining/available seed inventory; preferred varieties of other region (for prospect clients from other regions); and programs and trainings to be conducted. They are willing to put their contact numbers and email addresses in the information system platform in order to provide the farmers (customers) their authenticity and legal personality as accredited SGs. An online seed ordering system not only at PhilRice but at SGs' level may also be developed so that the unauthorized selling of untagged seeds may be reduced if not eliminated. Accordingly, the SGs are also willing to participate in curving this illegal selling of untagged seeds.

As observed, there is no website hub on which all information needed by farmers are available thus linkage and access to information is needed to be enhanced.

c. *Current Interventions to Enhance Seed Accessibility and Availability*

The national government has several interventions such as the national rice program (NRP) and the most recent one, the enactment of the RCEF seed component of the RA No. 11203. The NRP provides funds for the reserve or buffer stocks of rice seeds that are used during unforeseen events such as the occurrences of typhoons, floods, and drought that affect the crops. The DA thru the RFOs are the conduits in putting up the reserve stocks for the CS and BPI for the higher seed classes (FS and RS).

According to SGs, the planting materials used for seed production are from PhilRice, cooperatives, fellow SGs, and own produce, depending on the seed class they produce. SGs who are engaged in the production of FS to RS source out their planting materials from PhilRice only. The individual SGs only availed FS from PhilRice when they are endorsed by their respective DA-RFOs. The SGs wish that FS should always be available at PhilRice at the time they need. On one hand, SGs who produce RS to CS availed their seeds at PhilRice, cooperative or fellow SGs and sometimes from their own produce (if they were endorsed). All seeds produced by these accredited SGs need to pass testing and certification from BPI-NSQCS before these should be sold.

Currently, the seeds produced are being distributed to NRP, cooperative, fellow SGs, and farmers. Big portion of the produce goes to the government procurement through NRP. Based on the FGD conducted, 75% of SGs' produce go to government procurement, while the rest (25%) goes to fellow GPs and farmers for RS and CS, respectively. These customers (SGs and farmers) are either from their own provinces or other regions. For Isabela SGMPC members, half of their CS produce goes to the government, 40% is sold thru dealers and only 10% is directly sold to farmers (Fig. 5).

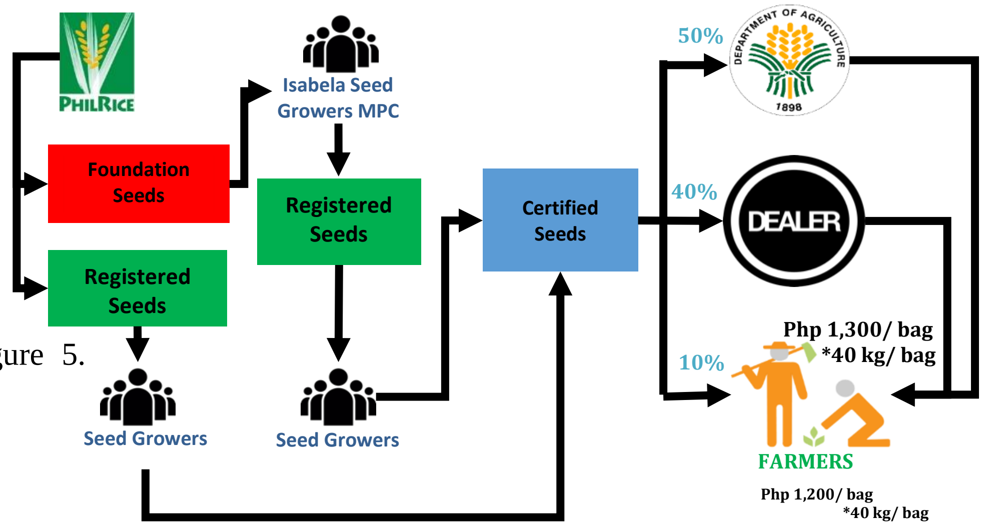

Figure 5. Seed distribution flow from PhilRice to cooperatives and SPs to farmers.

Source: Based on the FGD with Isabela Seed Growers MPC

d. Pricing, Cost, and Profit

Table 6 shows the production cost of SGs from Isabela and Nueva Ecija. Average production cost per hectare is about Php 61,400, or about Php 10 per kg at an average yield of 6 tons per ha. Based on our interview with Isabela and Nueva Ecija SGs, majority of their expenses (about 65%) are spent on labor-intensive activities such as land preparation, transplanting, and harvesting; followed by fertilizer inputs at 15% and postharvest/processing activities at 10% while seeds account to 3% only.

Table 6. Production cost per hectare for CS, Nueva Ecija and Isabela, 2019.

Items	Nueva Ecija	%	Isabela	%	Average	%
Seeds (planting materials)	1,840.00	3	2,300.00	4	2,070.00	3
Land preparation	12,333.33	18	6,000.00	11	9,166.67	15
Seeding and transplanting	11,700.00	17	8,250.00	16	9,975.00	16
Fertilizers	9,750.00	15	7,400.00	14	9,450.00	15
Chemicals (pesticides, herbicides, etc.)	1,690.00	2	825.00	2	1,257.50	2
Hired labor	12,210.00	18	13,000.00	25	12,605.00	21
Harvesting (includes hauling)	11,475.00	16	9,925.00	19	10,700.00	17
Seed processing (drying,	7.638.67	11	4,350.00	8	5,994.33	10

Items	Nueva Ecija	%	Isabela	%	Average	%
cleaning, and bagging)						
Seed certification	200.00	0	275.00	1	237.50	0
Total	**68,837.00**	**100**	**52,325.00**	**100**	**61,456.00**	**100**

As required by BPI-NSQCS for seed grower accreditation, seed production area should be irrigated or have access to irrigation (via water pump).

From the information provided, it was also observed that SGs still apply a higher seeding rate of 45 kg per ha compared to the prescribed 40 kg per ha seeding rate. When asked regarding this, the SGs responded that they provide some allowances for damaged seedlings during transplanting, and replanting of seedlings for missing hills.

Similar to SGs, labor remains to be the highest cost driver of seed production cost at PhilRice following the legally prescribed monthly rate of laborers hired as service contractors. Aside from labor, all cost components are almost similar for FS and RS production except for the cost of seeds, where different seed classes of planting materials are used.

Summarizing the profit margin that PhilRice and SGs gain from their seed production activities, the following figures were arrived at as presented in Table 7.

Table 7. Profit margin for FS, RS, and CS production, 2019.

Seed Production	Selling Price (Php per kg)	Production Cost (Php per kg)	Net Profit (Php per kg)	Profit Margin (%)
Foundation	88.00	31.72	56.28	63.90
Registered	46.00	29.82	16.18	35.17
Certified	38.00	10.20	27.80	73.16

The SGs are taking much of the profit margin considering their technical efficiencies and carrying capacities in terms of lowering their cost of production. They are better off than PhilRice as they maximize the labor in every crucial activity in seed production.

e. Post-Distribution Customer Service

As entrepreneurs, SGs believe in the importance of engaging their customers even after their transactions are completed. According to them, attending to inquiries and needs is one way of after-sales service to customers. Customer services have the advantages such as: 1) provide guidance and extend technical assistance to their customers to improve their yield; 2) receive customer feedbacks that would suggest areas that they still need to improve in seed production; and 3) build customer relationships and establish customer loyalty. They conduct costumer follow-ups or after-sales service through phone calls and SMS, and field visits.

Other SGs though, do not conduct any follow-up with their customers as they assume that if the customer is satisfied with the quality of the seeds they sell, they will repeat purchase for their seeds next planting season. In rare occasions, a customer will complain about poor or low germination. While this is a common complaint, seed growers investigate first their procedure in seed soaking as well as conduct ocular inspection of the farmer’s area if nearby. While incidence of customer complaints is rare, if the complaint is deemed valid, seed growers are willing to replace the seeds.

f. Analysis of the Rice Seed Value Chain

Considering the results of the FGD conducted in Isabela and Nueva Ecija, below shows the SWOT and analysis of the rice seed value chain.

Strengths. The presence of strong government interventions from the DA-RFOs and other DA agencies such as PhilRice, PhilMech, ATI, and BPI is a strength in both Isabela and Nueva Ecija. Owing to this strong presence of agencies, both provinces are home of the majority of the seed growers in the country. These two provinces are quite advance in terms of farm mechanization and support.

The technologies generated for rice seed and rice production are available and being cascaded by all DA agencies. Learning avenues are open to all farmers thru ATI and BPI for SGs. Hence, Nueva Ecija and Isabela have higher average yield per hectare.

Weaknesses. The seasonality of the rice crop across provinces, regions, and islands is very evident because of the availability of rainfall and irrigation water. The planting season is almost at the same time in almost all parts of the country that is why the demand for seeds is not met at times. There has always a delay of the supply of seeds as same planting and harvesting time occurs. This is the most pressing concern of all SGs and farmers. The influx of seeds for seed testing, analysis, and certification also at the same period also causes delay of tagged seeds that should be released in time of need. This provides an avenue for the untagged seeds to be sold even before the quality certification is issued.

The deficiency of the existing facilities from machineries at the farm to the storage also contributes to the deterioration of the seeds. All these cause delay in the availability of both higher and lower seed classes and distribution of seed subsidies to farmers.

When rice crops are established way ahead of the scheduled release of water from irrigation water, the SGs and farmers use fuel to run their water pumps. The cost of fuel is just so high that makes the production cost even higher than usual.

The devolution of the LGUs has also a great effect to the rice seed industry. The case of the SIs who are devolved in the LGUs is a weakness in the system. Though they are deputized as SIs, they are not administratively under the DA nor BPI-NSQCS to easily comply with their tasks and regular activities. They are given other workloads aside from field inspection and seed sampling. This makes the system fragmented at some point and degree. The lack of incentive and direct accountability over the field inspection and seed sampling make them less motivated to do best.

Opportunities. The seed production in these two provinces boosted the economy as the productivity and profitability increased. Incomes from farming are higher owing to seed production venture while helping create employment opportunities in the countryside. The technological advancements are rapidly changing and introducing them is quite an opportunity to enhance the rice seed industry. The RA No. 11203 has one hand, also created opportunities for inbred rice seeds to be in the forefront rather than hybrids, ie., PhilRice to produce the RS and sell to SGs, procure the CS from SGs, and distribute the CS to farmers.

Threats. While the trade liberalization provides opportunity for the SGs to supply the CS for distribution to farmers, it likewise poses threats to the rice seed industry because of the low price of commercial *palay (rough paddy)*. The government is trying its best to mitigate and ease this looming effect, however, the farmers are affected so much. The low price of *palay* is exactly in contrast with the high production cost brought by pricey fertilizers and other inputs such as fuel (in irrigation tail end and rainfed areas) and labor. Yet, the price of *palay* is continuously declining, from a high of Php 22/kg to Php 12/kg (fresh). The soaring prices of fertilizers, fuel, and chemicals threaten the rice sector that may trigger the farmers to convert their agricultural lands into other uses not only for other crops but for conversion into commercial or industrial areas. Not to mention other factors such as inclement weather, the farmers are quite adamant in pursuing farming.

The rice tariffication law may also be looming the SGs especially when multi-companies would eventually decide to venture into inbred seeds. This threat had been anticipated that is why the procurement of CS from the SGs is now currently done. However, this mitigating scheme should carefully be taken with all the anticipated actions of powerful business sharks so that necessary measures shall be in place before it becomes late.

g. The Porter's Five Force Analysis

As mentioned, the rice seed industry is generally regulated by government thru impositions of policies that affect the players in the rice seed system. Volume of supply for the higher seed classes is only sourced from PhilRice as the main seed producer of higher seed classes. Production of CS is handled by the private sector, represented by the SGs cooperatives and individual SGs.

Using Porter's Five Force Analysis, the rice seed system is analyzed based on its current status and the driving forces which influence the dynamics of the rice seed production and distribution system.

i. Threat of New Entrants

The CS market is the domain of the SGs. While there are some government regulation requirements to be complied by the SGs in order to operate his seed center, there is no direct restrictions or barriers to entry in starting CS production. In fact, the number of SGs being accredited by BPI-NSQCS as well as their seed production areas have been growing, indicating that the market for seeds has not yet reached saturation level and domestic production of rice is still favorable.

However, during our interviews with some SGs, they mentioned about the existence of *"seed blowers"* or individuals or entities who sell CS that did not undergo any seed certification or quality analysis, and therefore not accredited by the BPI-NSQCS. The presence of *seed blowers* poses a threat among accredited SGs as their CS compete with these unregulated CS. A legitimate seed, such as the CS, bear a seed tag issued by the BPI-NSQCS as proof of quality for the product being sold. This gives the farmers (consumers), the assurance that the seeds are of high-quality and came from a trusted source.

While CS for sale from *seed blowers* do not have seed tags, unknowing farmers have fallen prey on these unscrupulous sellers as the price is cheaper than the market price of CS.

They even imitate the sack or packaging of accredited cooperatives in order to make their product look authentic. Cooperatives tried to change their packaging but *seed blowers* are still able to copy the updated version. At the point of view of the seed growers, the presence of *seed blowers* has not only captured a portion of their market but also gave seed growers a negative reputation among their customers due to problems on low germination, contamination, and overall poor quality.

The selling of untagged CS may also be the making of some SGs who wish to take advantage of their accreditation and their customers who had been loyal to them. The case is on making their accreditation active while making profit out of those seeds that did not undergo analysis and certification.

ii. Bargaining Power of Costumers/Buyer

Costumers are free to choose where they will buy their seeds. That is why building customer loyalty by maintaining a good reputation of the seeds they sell is highly considered by SGs in their transactions with farmers. In Nueva Ecija and Isabela provinces, farmers can buy CS anywhere as there are many SGs within these provinces. Farmers from other provinces buy CS in either Nueva Ecija and Isabela because they have many accredited SGs. Sometimes, provinces other than Nueva Ecija and Isabela have limited supply of the preferred rice variety or not available at all. Hence, Isabela and Nueva Ecija SGs are mostly the source of CS.

iii. Bargaining Power of Suppliers

In the rice seed industry, the main supplier of RS which are used as planting materials for the production of CS is PhilRice. However, PhilRice cannot cover all the demanded volume for RS so other seed producers are tapped such as DA RFOs, SUCs, individual SGs, and SG cooperatives. These are given special endorsement to access FS at PhilRice for their planting materials for RS production.

However, selling price of RS is already set by the government so in terms of seed price, suppliers cannot dictate or influence the market. They have the bargaining power when they pool themselves as cooperatives or federation of cooperatives. With the procurement act of the Philippines, the SGs have to bid in order to supply the CS requirement of the government. The bidding requires legal personalities of the cooperatives, complete documentation, and process that will make the procurement transparent and giving equal opportunities to all suppliers.

iv. Threat of Substitute Products

Aside from inbred seeds, hybrid rice is another alternative that farmers consider in producing commercial rice. While hybrid claims to give an 18% yield advantage over inbred rice varieties, there are still drawbacks and limitations for farmers going into commercial hybrid rice production.

For the farmers, the price of hybrid seeds which is significantly higher than inbred rice seeds are one of the main threat drivers. Price of hybrid rice seeds cost of at least P212 per kilogram (price of public hybrid, price of hybrid from private companies costs even higher) compared to Php 38 per kilogram of inbred CS.

On the side of the SGs, though the price of hybrid is higher than CS, F1 seeds of hybrid rice should be produced in areas with good irrigation and favorable weather condition in order to achieve a high yield. Hence, not all areas are suitable for F1 production, crop care and management technologies and practices are even more stringent than inbred, and yield is not yet stable at 1 t/ha. Though the price is at P212/kg, the assurance of getting this yield level is not ascertained.

Another substitute for authentic CS or of any seed class are those inbred seeds produced by unaccredited SGs or seed centers. These seeds are cheaper than the truthfully tagged CS. Those seeds produced by other projects handled by other agencies or even PhilRice may also become substitute. Other projects are providing RS to partner-SGs and they eventually distribute these to farmers. While this may hasten the promotion of the use of modern varieties, it also breaks the formal seed system. At some point, the CS produced out of these projects may no longer be subjected to seed analysis and certification but provided to farmers.

Other crops may also be substitute for CS. Farmers may venture into other high-value crops if the current price of *palay* will continuously prevail.

v. Intensity of Competitive Rivalry

During our interview with SGs, it can be observed that there is healthy competition among the SG cooperatives. As they are members of cooperatives, they are taking demands from the government and farmers, and they supply the requirements. Each member-SG commits their area to meet the volume required for the supply of seeds. While the government has the procurement program for CS, the SGs are competing healthily. They have their own customers that regularly buy seeds every season.

Recommendations and Conclusions

Chapter 4

1. Recommendations to Rice Seed Production and Distribution System in the Philippines

Basing on the results of the FGD and considering the current situation and condition of the rice seed industry players, their existing practices and facilities, and policies and regulations, the following are the identified needs and recommendations:

a) ***Appropriate storage facilities to ensure availability of higher seed classes of varieties***

As PhilRice is the source of BS, FS, and RS, the availability of seeds should be assured for the seed producers to procure anytime. The availability of seeds is affected by some factors such as the seasonality of the crop where almost all the SGs in the major rice-producing areas plant at the same time with PhilRice at CES and branch stations. As such, the timeliness of the seed availability is one problem that need to be resolved. Planting in advance of at least a season and storing these seeds may be recommended to address the need of seeds during coincidence of planting and harvesting of PhilRice with that of the SGs.

Storing the seeds relatively longer than the usual 3-4 months would enable PhilRice to address the requirements of the SPs anywhere in the country. For this purpose, improved storage facilities would be needed. The improvement of the warehouses will focus on their ability to uphold the seed viability longer than 3-4 months after certification. With monitoring devices, an equilibrium balance of the RH and temperature that provides the best environment to store rice seeds is one of the features and important improvements that should be installed. An enhanced storage facility for each of the branch stations also improves the monitoring of abiotic stresses inside so that the desirable temperature and RH are monitored in equilibrium. The desirable equilibrium would ensure the sustainability of the quality of the seeds. Along with RH and temperature monitoring devices, appropriate warehouse and cool storage shall also be in place. The existing warehouses may be improved with special additions of devices and other amenities and/or constructing a new considering all the factors stated above.

The distribution of seeds especially for higher seed class (FS) and even RS may also be rationalized properly when the storage facilities are fully equipped with the necessary gadgets and equipment.

b) ***Interconnectivity of PhilRice to its branch stations, partner agencies, and SGs thru ICT***

Taking advantage of the rapid technological changes on ICT is a great opportunity to put a central command system that connects PhilRice CES and its branch stations, partner agencies such as BPI-NSCQS and BPI-Crop Research and Production Support Division (BPI-CRPSD), and SGs. This central command system will put in place a tool to collect data from the ground, consolidate and process them to become reports at any particular or given time. A tracking facility to monitor progress in seed production, in storage, and in distribution at a particular and given time can be done. Production estimates to actual production volume with results of analysis and seed certification may be generated, consolidated, monitored, and basis for decision making and implementation.

Along this interconnectivity and mobile/computer programs and applications are the following:

1. ***Seed production information system***

   At PhilRice as source of higher seed class, a system shall be put in place that can capture the materials, activities, and technologies applied for particular field lots from the time the seeds are soaked up to its harvesting and processing. This system shall provide an information about the crop and status per production area and station per seed class, per variety, per production-in-charge on per season per year basis thru a mobile application. A centralized command system where the seeds can be tracked down from harvesting to post-production. The information can be viewed, retrieved, and served as basis for both short- and long-term decision-making and project planning and implementation.

2. ***Warehousing and storage management information system***

   As a continuum of the seed production information system, an ICT-based warehousing and storage management system is also needed. The system shall include a dynamic planning and implementation scheme to generate information on the proper layout of the warehouse for better storage and handling. Monitoring devices for RH and temperature inside the warehouses shall be installed at PhilRice CES and branch stations. It will also provide real-time inventory for distribution and production planning and implementation. Similarly, this shall require a central command system that connects all the branch stations.

3. ***Distribution-production information system***

Taking the whole gamut of the rice seed information system, the distribution-production information system shall complete it which entails not only at PhilRice but also the BPI-NSQCS and SGs. This system will provide an avenue where the SGs procure seeds from PhilRice, tag their production areas upon planting and apply for field inspection and seed certification, and results of seed analysis and certification from the BPI-NSQCS.

4. ***Online reapplication and approval of SGs accreditation***

The thought of printing multiple pages of paper applications for seed analysis and certification, paying in cash, and waiting weeks for a response or results seem to be too time consuming when there is viable way that can be obtained with less time, effort, and cost. Making the application process as easy as possible will give much convenience to SGs that will pave a way to knowing the estimated and actual production of CS and SPs/SGs as sources. With digitally knowledgeable and reliant society, some SGs wish to adapt online transaction and posting in BPI-NSQCS accreditation and results. At PhilRice, this is a process that will complete the traceability of seeds from PhilRice to SPs/SGs and vice versa.

5. ***Automation of reporting and processes of implementing and regulating agencies***

Manual collecting, encoding, and consolidating of data are tedious work to SCs and SIs, and also to BPI-NSQCS and PhilRice. Also, it is time consuming and prone to errors such as duplications and inconsistencies. Automation of reports will reduce or eliminate the pen and paper method, and will fast track the availability of data. With the ongoing rapid software and ICT advancement, this is very possible for the rice seed industry.

6. ***Online payment for fees and related charges for SPs/SGs accreditation and seed testing***

As we enter the cashless era where financial transactions are executed in an electronic format, SPs/SGs wish to amend the existing payment scheme to online payment. According to them, this is more convenient and transactions are faster. This aspect, however, is not within PhilRice coverage but of BPI-NSQCS as it has the mandate to review application and accreditation of SPs/SGs.

This last item is not within the purview of PhilRice, hence, this clamor of the SGs per result of the FGD will be forwarded to BPI-NSQCS for its action and possible consideration.

2. Summary of Findings and Conclusion

The enabling environment for the rice seed value chain is quite in place specifying the players and their roles in the industry. PhilRice is playing a very crucial role as much as rice seed production is concerned while BPI-NSQCS is also vital in providing regulatory and oversight functions in quality seed certification. The DA-RFOs are also playing an important role in overseeing the overall rice production in their area coverage. To implement this, they determine the number of SGs that are needed in their regional coverage. The SUCs and SGs (individual and cooperatives) are likewise very important in the whole rice seed system as they are the finishers of the loop connecting to the final beneficiaries, the farmers. With the rice tariffication law, PhilRice is now engaging these SGs to produce the CS for distribution to farmers, so this is an additional challenge for PhilRice. The opportunities brought by these laws are just enormous, however, the concerns and issues besetting them are also quite challenging. The rice tariffication law may also be looming among SGs when seeds also coming in while its effects to farmers producing *palay* is now currently felt thru low price of *palay*.

The cases of Isabela and Nueva Ecija provide information on how the rice seed system in the Philippines works. These two provinces are the home of the majorities of the SGs in the country and produce the highest yields. The SGs are the most active members of the federation of cooperatives and are consistently linking with government agencies and private dealers and farmers. Half (50%) of their produced seeds are sold to the government and the other half (50%) is sold to dealers and farmers (40% and 10%, respectively). Clamors of the SGs are the timely availability of FS and RS at PhilRice so they establish their seed production upon onset of water from both rainfall and irrigation.

In general, the rice seed system is being challenged with the distribution of untagged seeds as brought by many factors. The factors may include the same planting time of all – PhilRice, SGs, and farmers, causing some difficulties to match the timeliness of quality-certified seeds of all seed classes. Those seed inventories are stored in inappropriate warehouses and storage facilities, causing declines in seed viability. When SGs of areas with different planting dates need seeds, the germination rate of seeds become low. PhilRice has to address the timeliness of availability of higher seed classes so prospective SGs from different planting times may also be encouraged to engage in seed production. This can be done thru the improvement of the warehouse and storage facilities. Along with the improved warehouse and storage facilities, a rice seed information system embodying all the players and activities of the industry should also be deployed and operationalized. This will provide a more holistic approach to put the rice seed value chain in good shape and to help the government address its quest toward a food-secure Philippines.

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Annex 1. Rice production status, 2000-2018.

Year	Total Production (metric tons)	Area Harvested (ha)	Yield/ Hectare (t/ha)	Value (in thousand pesos)	Farmgate Price (P/kg)	Sufficiency Level	
						Surplus/ (Deficit)	% Suff. Level
2000	12,389,412	4,038,085	3.07	104,318,849	8.42	-977,091	92.69
2001	12,954,870	4,065,441	3.19	105,841,288	8.17	-1,236,027	91.29
2002	13,270,653	4,046,318	3.28	117,047,159	8.82	-1,828,508	87.89
2003	13,499,884	4,006,421	3.37	119,338,975	8.84	-1,354,742	90.88
2004	14,496,784	4,126,645	3.51	136,994,609	9.45	-1,530,617	90.45
2005	14,603,005	4,070,421	3.59	152,309,342	10.43	-2,785,665	83.98
2006	15,326,706	4,159,930	3.68	160,317,345	10.46	-2,624,461	85.38
2007	16,240,194	4,272,889	3.80	182,214,977	11.22	-2,760,852	85.47
2008	16,815,548	4,459,977	3.77	237,603,693	14.13	-3,716,257	81.90
2009	16,266,417	4,532,310	3.59	237,977,681	14.63	-2,685,484	85.83
2010	15,772,319	4,354,161	3.62	234,534,384	14.87	-3,634,989	81.27
2011	16,684,062	4,536,642	3.68	253,097,221	15.17	-1,081,950	93.91
2012	8,032,525	4,690,061	3.84	130,287,556	16.22	-708,932	91.89
2013	18,439,420	4,746,091	3.89	312,179,381	16.93	-605,633	96.82
2014	18,967,826	4,739,672	4.00	380,684,268	20.07	-1,660,587	91.95
2015	18,149,838	4,656,227	3.90	314,536,693	17.33	-2,259,291	88.93
2016	17,627,245	4,556,043	3.87	307,242,880	17.43	-925,016	95.01
2017	19,276,347	4,811,808	4.01	351,022,279	18.21	-1,353,305	93.44
2018	19,066,094	4,800,406	3.97	388,948,318	20.40	-3,060,045	86.17

Philippine Statistics Authority, 2018 data

Annex 2. Regional rice production and area harvested, 2018.

	Area Harvested (ha)			Production Volume (tons)		
	Semester 1	Semester 2	Annual	Semester 1	Semester 2	Annual
PHILIPPINES	2,127,651.80	2,672,754.30	4,800,406.10	8,713,216.26	10,352,877.68	19,066,093.94
CORDILLERA ADMINISTRATIVE REGION (CAR)	45,467.00	65,920.00	111,387.00	203,540.00	187,564.60	391,104.60
REGION I (ILOCOS REGION)	101,121.00	304,860.39	405,981.39	490,108.00	1,229,935.52	1,720,043.52
REGION II (CAGAYAN VALLEY)	312,682.80	249,334.71	562,017.51	1,479,428.46	900,342.96	2,379,771.42
REGION III (CENTRAL LUZON)	326,819.00	400,885.00	727,704.00	1,808,464.00	1,806,651.12	3,615,115.12
REGION IV-A (CALABARZON)	59,349.00	49,300.63	108,649.63	232,174.00	188,059.47	420,233.47
MIMAROPA REGION	125,797.00	180,993.00	306,790.00	490,230.00	740,758.37	1,230,988.37
REGION V (BICOL REGION)	178,418.00	179,236.00	357,654.00	668,098.00	682,340.32	1,350,438.32
REGION VI (WESTERN VISAYAS)	242,481.00	426,380.00	668,861.00	736,371.00	1,495,921.75	2,232,292.75
REGION VII (CENTRAL VISAYAS)	48,489.00	49,130.00	97,619.00	157,971.00	151,488.00	309,459.00
REGION VIII (EASTERN VISAYAS)	158,154.00	111,632.00	269,786.00	538,214.00	408,662.96	946,876.96
REGION IX (ZAMBOANGA PENINSULA)	73,541.00	103,999.32	177,540.32	296,104.00	432,569.43	728,673.43
REGION X (NORTHERN MINDANAO)	72,985.00	91,784.00	164,769.00	317,447.00	443,953.32	761,400.32
REGION XI (DAVAO REGION)	51,101.00	55,449.00	106,550.00	232,135.00	255,969.68	488,104.68
REGION XII (SOCCSKSARGEN)	145,982.00	202,498.25	348,480.25	517,842.00	825,282.70	1,343,124.70
REGION XIII (CARAGA)	91,796.00	68,486.00	160,282.00	298,877.80	211,192.92	510,070.72
AUTONOMOUS REGION IN MUSLIM MINDANAO	93,469.00	132,866.00	226,335.00	246,212.00	392,184.56	638,396.56

Philippine Statistics Authority, 2018 data

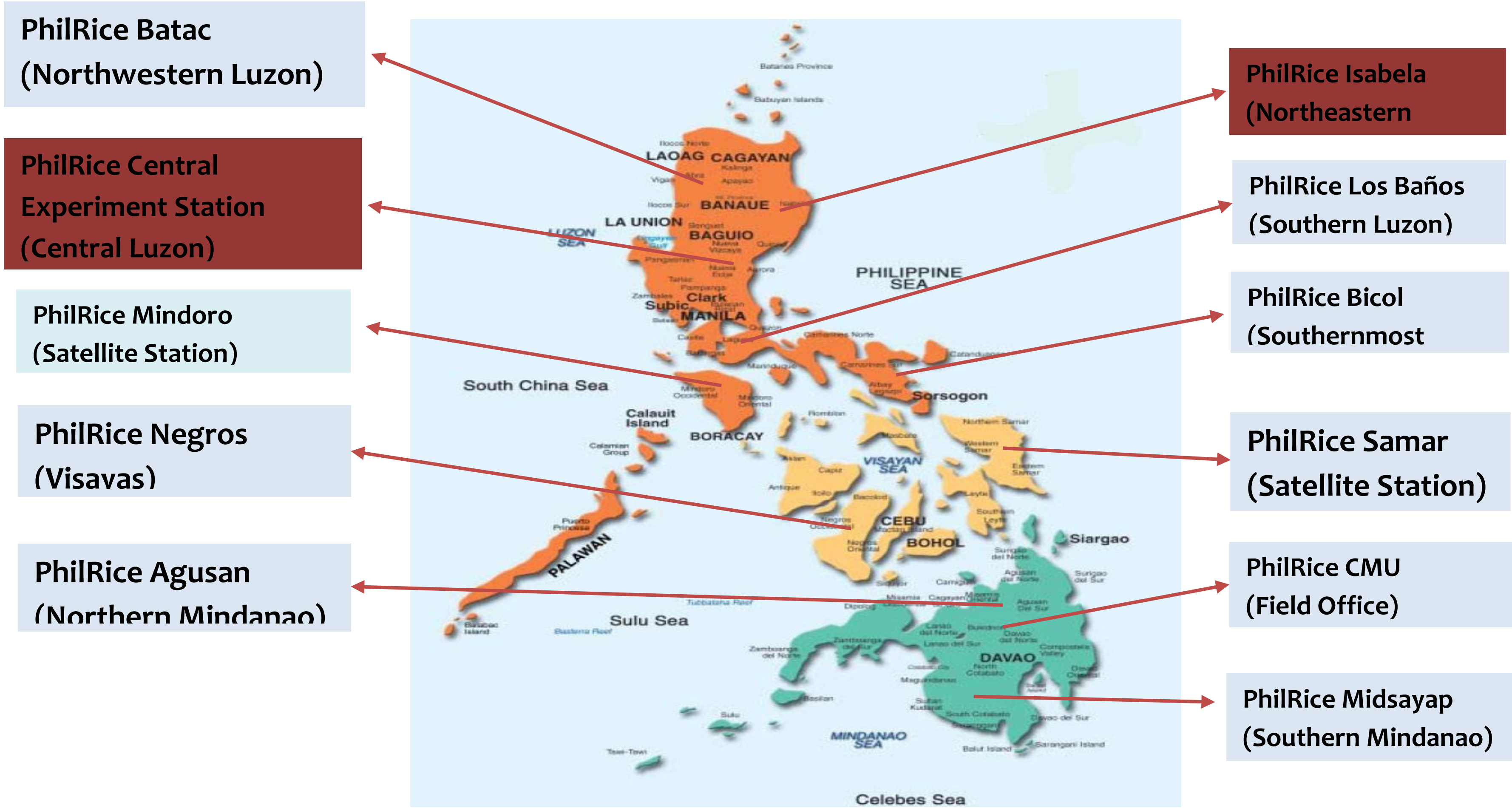
Annex 3. Government policies and regulations on production, analysis, certification, and distribution.

POLICY INSTRUMENTS	TITLE/PROVISION
Republic Act No. 7308 of 1992	Seed Industry Development Act
Republic Act No. 7607 of 1992	Magna Carta of Small Farmers. Sect 16. Use of good seeds and planting materials – every farmer has the equal opportunity to avail of, to produce and to market good seeds and planting materials.
Republic Act No. 9166 of 2002	Plant Variety Protection Act – an act providing protection to newly discovered and developed varieties that are distinct, uniform and stable
AO No. 20, Series of 2005	Revised seed and field standards for the production of hybrid rice parental seeds (A CMS Line, B or maintainer Line and R or Restorer Line)
AO No. 18, Series of 2005	Revised criteria for accreditation of hybrid rice seed growers/producers
AO No. 19 Series of 2005	Revised Criteria for the Accreditation of Seed Producers
AO No. 06. Series of 2006	Guidelines on the Production, Regulation, Promotion, Procurement and Distribution of Seeds and Planting Materials
AO No. 18, Series of 2007	Revised Seed and Field Standards for the Production of Hybrid (F1) Seeds and Hybrid Rice Parental Seeds (A or CMS Line, B or Maintainer Line, and R or Restorer Line)
AO No. 19, Series of 2007	Revised Criteria for Accreditation of Hybrid Rice Seed Growers/Producers
AO No. 20, Series of 2007	Revised criteria for accreditation of inbred rice seed growers/producers
AO No. 21, Series of 2007	Revised guidelines on rice seed certification
AO No. 08, Series of 2008	Prescribing the buying of inbred rice seeds (amending AO No. 10, Series of 2006)

POLICY INSTRUMENTS	TITLE/PROVISION
AO No. 29, Series of 2008	Revising AO No. 15, Series of 2008 prescribing the buying and selling of hybrid rice
AO No. 04, series of 2010	Seed and Field Standards for the Production of Two-Line Hybrid, Thermosensitive Genetic Male Sterile (TGMS) line and Pollen Parent
AO No. 03, Series of 2010	General Guidelines on Re-testing for Germination of Carry Over Seed Lots of Inbred and Hybrid Rice Seeds
AO No. 16, Series of 2010	Revised guidelines on Inbred rice seed certification
MO No. 20, Series of 2011	Guidelines on the implementation of community-based seed banks
AO No. 09, Series of 2014	Fees and Related Charges of the National Seed Industry Council
Department Circular No. 06, Series of 2018	General Guidelines and Requirements for the Accreditation of Private Seed Testing Laboratories
Department Circular No. 09, Series of 2018	Revised Guidelines for the Accreditation of Inbred Rice Seed Growers/Producers
Department Circular No. 15, Series of 2018	Amending the Buying and Selling Prices of Inbred Rice Seeds

Source: National Seed Industry Council Website (www.nseedcouncil.bpinsicpvpo.com.ph)

Annex 4. PhilRice Central Experiment Station and Branch/Satellite Stations



Annex 5. Photo Documentation

Visit of KREI and PhilRice Team to Isabela seed growers

Key informant interview with the Assistant Center Chief of BPI-NSQCS Region II

Visit to PhilRice Isabela warehouse facility

FGD with seed growers in Isabela

FGD with seed growers in Nueva Ecija

FGD with the DA Region 3 seed coordinator, Nueva Ecija seed coordinator, and a seed inspector from Cabanatuan City, Nueva Ecija