2021 PCAARRD ANNUAL REPORT

Harnessing the Gains of

GALING-PCAARRD

DEPARTMENT OF SCIENCE AND TECHNOLOGY (DOST)
PHILIPPINE COUNCIL FOR AGRICULTURE, AQUATIC AND NATURAL RESOURCES RESEARCH AND DEVELOPMENT (PCAARRD)

About DOST-PCAARRD

The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) is one of the sectoral councils under the Department of Science and Technology (DOST). It was formed through the consolidation of the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) and the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) on June 22, 2011 pursuant to Executive Order No. 366.

Originally established in November 10, 1972 as the Philippine Council for Agricultural Research (PCAR), it became the Philippine Council for Agriculture and Resources Research (PCARR) to include mines research in 1975. Affirming the role of science and technology (S&T) in development, PCARR changed its name to Philippine Council for Agriculture and Resources Research and Development (PCARRD) in 1982. The Council was tasked to provide a unified and focused direction for the country's agricultural research. It then became an apex organization that supports and manages the national network of government and higher education institutions involved in crops, livestock, forestry, fisheries, soil and water, mineral resources, and socio-economic research and development (R&D). In 1987, the Council was renamed the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development but retained the acronym PCARRD. On January 30 of the same year, the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) was created from the Fisheries Research Division of PCARRD with functions focused on aquatic and marine sectors.

With expanded coverage, functions, and responsibilities, the Council formulates policies, plans, and programs for S&T-based R&D in the different sectors under its concern. It coordinates, evaluates, and monitors national R&D efforts in the agriculture, aquatic, and natural resources (AANR) sector. It also allocates government and external funds for R&D and generates resources to support its program.

As the apex Council of the AANR sector, PCAARRD is engaged in active partnerships with international, regional, and national organizations and funding institutions for joint R&D, human resource development and training, technical assistance, and exchange of scientists, information, and technologies. The Council is implementing its program primarily through its regional consortia, which are located all over the country.

It also supports the National Agriculture, Aquatic and Natural Resources Research and Development Network (NAARRDN) composed of national multi- and single-commodity and regional R&D centers, cooperating stations, and specialized agencies.

Being an ISO 9001:2015-certified agency for its quality management system, PCAARRD is committed to achieving a sustained dynamic leadership in science and technology (S&T) innovation in the AANR sector by providing strategic leadership in promoting S&T as a platform for AANR products innovation and environment resiliency. Guided by its core values of relevance, excellence, and cooperation, PCAARRD will remain steadfast in catalyzing the Philippine AANR sector toward self-sufficiency and global competitiveness.

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Los Baños, Laguna
2022

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MESSAGE FROM THE SECRETARY

FORTUNATO T. DE LA PEÑA
Secretary
DOST

Two years into the coronavirus disease 2019 (COVID-19) pandemic, the Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) has remained steadfast in supporting the growth and productivity of the agriculture, aquatic, and natural resources (AANR) sector. While the effects of the global health crisis are profound and overwhelming, it is undeniable that the same situation only heightened DOST-PCAARRD's commitment to develop, transfer, and commercialize science and technology (S&T) solutions that would strengthen the sector's value chain and augment the basic needs of our farmers, fisherfolk, and other stakeholders.

The major S&T accomplishments reported in this Annual Report have supported industries such as coconut, abaca, vegetables, mango, bamboo, native animals, and seaweed, among others, which spans the total landscape of the Council's Industry Strategic S&T Programs (ISPs) and cross-cutting activities. Aside from data-driven research and development (R&D) projects, this report also highlights the Council's major accomplishments executed in areas such as science, technology, and innovation (STI) human resources; capability building; and international collaboration. While the extraordinary circumstances have pushed the Council to recalibrate strategies and its projects and programs, we are convinced that these efforts are tailor-fit to address pressing AANR-related challenges in the Philippines and the Southeast Asian Region.

We, at DOST, are proud to have witnessed how the Council seized greater opportunities with its partners in the academe, research institutions, and community builders to formulate relevant policies, strategies, and modalities despite the upheaval of COVID-19. All of which proved to be effective in uplifting the lives of our fellow Filipinos.

As we continue to navigate through these complex times, I am confident that the Council will continue its transformative and remarkable S&T discoveries and bring infinite possibilities to the AANR. *Mabuhay ang* DOST-PCAARRD!

MESSAGE FROM THE UNDERSECRETARY FOR R&D

ROWENA CRISTINA L. GUEVARA, PhD
Undersecretary for Research
and Development
DOST

As the country adapts to the challenges of the "new normal," we commend DOST-PCAARRD for consistently performing its mandates with genuine compassion for the AANR sector.

This Annual Report, with the theme "Harnessing the Gains of GALING-PCAARRD (Good Agri-Aqua Livelihood Initiatives towards National Goals)," showcases the significant accomplishments of DOST-PCAARRD in delivering the goals of the DOST outcomes, particularly the targets of its ISPs. Guided by the DOST's Eleven-Point Agenda, this report covers the strategies that shall be implemented to achieve DOST's vision and desired outcomes—efforts that were pursued to ensure that STI will work for the people.

As we congratulate the men and women of DOST-PCAARRD, we also place equal recognition to the members of the National Agriculture, Aquatic and Natural Resources Research and Development Network (NAARRDN), particularly the regional R&D centers, academe, cooperating stations, and specialized agencies who were also instrumental in realizing these prime achievements. Let us rediscover from this report how these collective efforts have paved the way to a more competitive, resilient, and productive AANR sector.

Looking back at the year in review, it is gratifying to have witnessed how the noble work of DOST-PCAARRD has kept the agricultural communities afloat amidst the great deal of challenges brought by the health crisis. I hope that these achievements fuel the Council's desire to pursue more S&T solutions that are useful, relevant, and timely especially for our smallholder farmers and fisherfolk.

Congratulations, DOST-PCAARRD, for another surge of accomplishments. May you continue to discover newfound strengths as you deepen the S&T footprint in AANR communities across and beyond the Philippines. More power!

PREFACE

REYNALDO V. EBORA, PhD
Executive Director
DOST-PCAARRD

I take pride in presenting the accomplishments of the Council for 2021, where its core values of excellence, relevance, and cooperation were greatly highlighted. While the country continued to live in the new normal, DOST-PCAARRD did not falter in providing S&T products and services to address the emerging needs of the AANR sectors. This year, we indeed harnessed the gains of the GALING-PCAARRD, serving as foundation in creating initiatives for the benefit of our farmers and fisherfolk.

Apart from providing R&D support in the emerging needs of the crops, livestock, inland aquatic, marine, and forestry sectors, new R&D centers were established this year—native chicken, Queen pineapple (QP), garlic, cacao, bamboo, and cave ecosystem, strengthening our goal of providing necessary infrastructures to achieve our aspiration.

All these, we continue to attribute to the dedication of all DOST-PCAARRD staff who have continuously given their heart in providing services despite the challenges brought about the pandemic. We also owe this success to our partners who have always been with the Council throughout the years.

As we again face the challenges for 2022, we go back to our core values. We remember to aim for excellence in order to remain relevant, remembering the people who have been with us along the way in this new normal.

Congratulations! I hope that this year's accomplishments will inspire us to keep getting better.

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Executive Summary

In 2021, DOST-PCAARRD addressed 47 out of the 48 priorities indicated in the Harmonized National Research and Development Agenda (HNRDA) for the agriculture, aquatic, and natural resources (AANR) sector. A total of 783 projects were funded during the year with financial support from the DOST and DOST-PCAARRD Grants-in-Aid (GIA) Program. There were 840 projects monitored, which include newly supported and COVID-related projects, ongoing projects approved for renewal, projects approved for extension, and completed projects, which have not yet submitted terminal and financial reports as of the end of 2021. During the year, a total of 175 local and international partner agencies were established and/or maintained. From the 143 completed research and development (R&D) projects, 135 were reported by the implementers/researchers to have either been presented in various symposia, filed Intellectual Property (IP) protection, and/or published information, education, and communication (IEC) materials during the year.

Good Agri-Aqua Livelihood Initiatives towards National Goals (GALING-PCAARRD)

A total of 88 projects and 16 initiatives from existing DOST-PCAARRD projects had been approved under the program with an estimated total investment of P232 million (M) in collaboration with over 59 partner institutions. As of December, there were 27 completed and 51 ongoing projects across the Philippines.

DOST'S ELEVEN-POINT AGENDA

Agenda 1. Pursue R&D to Address Pressing National Problems. The Council supported research on bamboo textile, as well as the conservation and sustainable development of biodiversity in selected mountain ecosystems of Mindanao. Pilot testing of ACTICon™ as biocontrol agent against Fusarium Wilt (Foc TR4) in cavendish banana was conducted.

For the aquatic sector, the Council supported research on ProvitB1 as aquafeed for tilapia and milkfish and a study on the potential of Naujan white goby ('biyang puti') for aquaculture. The first successful ex-situ captivity of the endangered *Sardinella tawilis* was also recorded. Loop-mediated isothermal amplification (LAMP) detection kit for acute hepatopancreatic necrosis disease (AHPND) in shrimps and biofloc technology (BFT) in the nursery production of *Penaeus vannamei* were produced. In addition, the status of giant clams and advancing culture techniques was also assessed.

For the livestock sector, R&D outputs are currently used by the private sector to build ItikPINAS enterprises. Farmers' associations adopt and earn from native chicken technology. Biosecurity protocols towards Q-black repopulation, as well as DNA marker selection and meat quality assessment protocols for Philippine native pigs and beef cattle, were developed.

Agenda 2. Conduct R&D to Enhance Productivity and Improve Management of Resources. The Council supported research studies on value chain analysis and marketing of tamarind, documentation of indigenous vegetables in the Philippines, long staple processing of BANDALA (Backcross Abaca with Native and Desirable Accessions to Lift Up the Abaca Industry) for Philippine tropical fabrics, LAMP kits for mango diseases, nano-biosensor technology in disease surveillance and diagnosis of economically important crops, optimization of production and use of FertiGroe® nanofertilizers, green packaging for rice and other commodities, integrated pest management (IPM) for broccoli and strawberry grown in different production systems under protected structures, and management of unified control and automated system for smarter greenhouse hydroponics.
The Council also enhanced its "Policy Analysis and Advocacy Program"; established the Agri-Aqua Business Unit and "PCAARRD Applied Rural Sociology (ARS) Program in AANR"; and evaluation of PCAARRD Corporate Plan (CorPlan) Implementation.

Agenda 3: Engage in R&D to Generate and Apply New Knowledge and Technologies Across Sectors. The Council supported research on coastal acidification; radionuclide contamination screening from the Fukushima accident by Iodine-129 measurement in corals from the Philippines; status assessment of giant clams and advancing culture techniques; utilization of marine fisheries species in the production of protein hydrolysates; and macroalgae fermented-feed additive for chicken using microbial system.

Agenda 4: Strengthen and Utilize Regional R&D Capabilities. DOST-PCAARRD provided its regional consortia with a P36.2-M fund. Six new Niche Centers in the Regions (NICER) were also established.

Agenda 5: Maximize Utilization of R&D Results through Technology Transfer and Commercialization. For technology transfer and commercialization, the Council gained support from celebrity influencers in promoting native pig and native chicken technologies. It invested on "Integrated Social Marketing (ISM) Program" to promote the GALING-PCAARRD projects and "Biodiversity Science and Technology (S&T) Program," participated in national S&T promotion events and exhibits, engaged R&D consortia through AANR vlog, increased its social media presence, and facilitated technology commercialization through Farms and Industry Encounters through the S&T Agenda (FIESTA). Technologies and innovations were also promoted through printed IEC materials and an initiative for a broadened and increased access to R&D information through the DOST-PCAARRD eLibrary.

The Council filed 220 IP applications, trained 59 technology transfer officers on patent mining, and assisted 30 additional state university and colleges (SUCs) outside the Intellectual Property and Technology Business Management (IP-TBM) network. The 16 Agri-Aqua Technology Business Incubators (ATBIs) have supported and mentored a total of 302 businesses/incubatees using 92 technologies generated by the host institutions. Various platforms and events were also used for technology promotion.

Agenda 6: Develop Science, Technology, and Innovation (STI) Human Resources and Build a Strong STI Culture. The "Graduate Research and Education Assistantship for Technology (GREAT) Program" had 12 completers, supported 17 new scholars, and encouraged submission and approval of 5 re-entry proposals. Likewise, the Council approved new policies that allow GREAT students and alumni taking their Doctor of Philosophy (PhD) in research to apply under the "GREAT Program." Applicants under the "Publication Incentives Program (PIP)" continuously increased, with 108 journal articles provided grants. In addition, the Council provided incentives for 28 articles from DOST-PCAARRD funded projects and thesis/ dissertations. Furthermore, 37 training courses were offered online to 1,199 trainees from private and government institutions. Out of the 37 courses, 4 were accredited by the Professional Regulation Commission (PRC) for Continuing Professional Development (CPD) for agriculture units, further benefiting 36 licensed agriculturists.

Agenda 7: Upgrade STI Facilities and Capacities to Advance R&D Activities and Expand S&T Services. DOST-PCAARRD approved 29 facilities development projects were approved with a corresponding investment of P251 M, benefiting 17 partner institutions.

Agenda 9: Provide STI-based Solutions for Disaster Risks and Climate Change Adaptation and Mitigation. On addressing disaster risks, the Council supported research on crop characterization, integrated crop management (ICM), and model development of Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (SARAI); and developed smart environmental resilience solutions for coastal areas in the Philippines.

Agenda 10: Strengthen Industry-Academe-Government and International STI Collaboration. The Council supported the Los Baños Science Community Foundation, Inc. (LBSCFI). It also led the conduct of the first International Videoconference on Best Practices and Approaches on Agricultural Extension Modalities. DOST-PCAARRD-supported technologies were pitched in the ASEAN NEXT 2021: ASEAN Summit on Spin-off Technologies.

DOST-PCAARRD, through the signing of agreements, welcomed its international partners, namely: Southeast Asian Ministers of Education Organization (SEAMEO)-Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA); the Jiangxi Academy of Forestry (JAF) and Jiangxi Academy of Agricultural Sciences (JxAAS) of the People's Republic of China; and Michigan State University (MSU) in the United States of America (USA). Existing international partnerships were also maintained.

Agenda 11: Enhance Effectiveness of STI Governance. This year's accomplishments are due to the hard work and dedication of DOST-PCAARRD's 214 regular and 121 Institutional Contract of Service (ICOS) staff. The Council managed a P1.480-billion (B) budget. It also gave emphasis on continual improvement, knowledge management for AANR, and support to gender and development (GAD).

2021 GIA PORTFOLIO

By Region

CORDILLERA ADMINISTRATIVE REGION (CAR)
Proposals Evaluated: 37
Proposals Approved: 16
P270,128,973.95*

I - ILOCOS REGION
Proposals Evaluated: 9
Proposals Approved: 5
P14,893,906.00*

III - CENTRAL LUZON
Proposals Evaluated: 52
Proposals Approved: 22
P111,035,879.47*

IV-B - ORIENTAL MINDORO, OCCIDENTAL MINDORO, MARINDUQUE, ROMBLON, PALAWAN (MIMAROPA)
Proposals Evaluated: 9
Proposals Approved: 3
P14,998,500.00*

VII - CENTRAL VISAYAS
Proposals Evaluated: 28
Proposals Approved: 13
P42,839,805.79*

IX - ZAMBOANGA PENINSULA
Proposals Evaluated: 26
Proposals Approved: 11
P46,671,653.20*

BANGSAMORO AUTONOMOUS REGION IN MUSLIM MINDANAO (BARMM)
Proposals Evaluated: 5
Proposals Approved: 3
P71,585,885.78*

II - CAGAYAN VALLEY
Proposals Evaluated: 23
Proposals Approved: 8
P28,767,923.60*

NATIONAL CAPITAL REGION (NCR)
Proposals Evaluated: 74
Proposals Approved: 23
P437,063,381.68*

IV-A - CAVITE, LAGUNA, BATANGAS, RIZAL, AND QUEZON (CALABARZON)
Proposals Evaluated: 106
Proposals Approved: 62
P516,246,479.99*

V - BICOL REGION
Proposals Evaluated: 25
Proposals Approved: 7
P46,117,154.77*

VIII - EASTERN VISAYAS
Proposals Evaluated: 25
Proposals Approved: 7
P60,121,662.60*

VI - WESTERN VISAYAS
Proposals Evaluated: 45
Proposals Approved: 7
P79,887,469.44*

XIII - CARAGA
Proposals Evaluated: 16
Proposals Approved: 2
P6,120,615.74*

X - NORTHERN MINDANAO
Proposals Evaluated: 27
Proposals Approved: 9
P105,709,970.91*

XI - DAVAO REGION
Proposals Evaluated: 28
Proposals Approved: 6
P22,227,000.00*

XII - South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos City (SOCCSKSARGEN)
Proposals Evaluated: 2
Proposals Approved: 6
P37,403,819.00*

By Subsector

Aquatic
Proposals Evaluated: 93
Proposals Approved: 33
P445,009,470.78*

Crops
Proposals Evaluated: 101
Proposals Approved: 33
P177,819,964.75*

Forestry
Proposals Evaluated: 67
Proposals Approved: 23
P310,478,756.24*

Livestock
Proposals Evaluated: 46
Proposals Approved: 22
P189,923,058.61*

Socio-economic
Proposals Evaluated: 54
Proposals Approved: 33
P270,148,193.58*

Technology Transfer
Proposals Evaluated: 165
Proposals Approved: 56
P442,748,690.56*

Cross-cutting
Proposals Evaluated: 11
Proposals Approved: 10
P75,691,947.40*

R&D
448 EVALUATED
148 APPROVED
P1,574,362,780.28*

NON-R&D
89 EVALUATED
62 APPROVED
P337,457,301.64*

COMPLETED PROGRAMS AND PROJECTS
As of December 31, 2021, By source of fund

165
PCAARRD - 123
DOST - 42

CONTINUING PROGRAMS AND PROJECTS
As of January 1, 2022, By source of fund

516
PCAARRD - 406
DOST - 110

*Value of Newly-approved programs and projects in 2021

NOTE: PAPs evaluated comprise of proposals received in 2021 only. PAPs approved comprise of all proposals approved in 2021 regardless of the year it was received i.e. some proposals were received in 2020 but were approved in 2021.

GALING-PCAARRD

The "Good Agri-Aqua Livelihood Initiatives towards National Goals (GALING-PCAARRD Kontra COVID-19 Program)" was launched in 2020 as a quick response to the government-led efforts against COVID-19 pandemic. The program aimed to offer food production technologies, products, and livelihood from its various R&D projects in support of the Bayanihan to Heal as One Act, particularly in helping the country's food security initiatives.

In 2021, a total of 88 projects and 16 initiatives from existing DOST-PCAARRD projects had been approved under the program with an estimated total investment of P232 M in collaboration with over 59 partner institutions. As of December, there were 27 completed and 51 ongoing projects across the Philippines.

Teknolohiya-Kaalaman para sa Pamayanan

This component focuses on the sharing of technology and information through IEC materials using various platforms. Over 43,838 copies of IEC materials have been distributed covering 78 topics.

Lingkod Alalay sa Pamayanan (LINGAP)

This component focuses on the distribution of food and non-food products (e.g., disinfectants, alcohol, and personal protective equipment) and provision of support services to affected communities and frontliners. Since the program started, 16 projects were completed benefiting 5,055 households.

LINGAP was launched on July 30. Projects under the GALING-PCAARRD Program implemented by Ifugao State University (IfSU), Don Mariano Marcos Memorial State University (DMMMSU), Samar State University (SSU), and the Department of Agriculture's (DA) Bureau of Plant Industry-Los Baños National Crop Research, Development and Production Support Center (BPI-LBNCRDPSC) provided an alternative source of income to the affected farmers and fisherfolks in Luzon and Visayas. Through the event, a total of 515 packs of S&T products and goods (e.g., organic vegetables, herbs, and seedlings), processed fish (e.g. vacuum fried fish, and marinated deboned milkfish), sweetpotato (SP) tubers and products (e.g., flour, muffins, chips, fries, and cookies), planting materials, and vermicompost, among others were simultaneously distributed to the community beneficiaries in their respective areas.

Pagkain at Kabuhayan sa Pamayanan

This component is divided into three sub-components, namely: Gulayan sa Pamayanan, Tilapia sa Pamayanan, and Manok at Itlog sa Pamayanan. The projects under this component were able to produce fish, eggs, and fresh vegetables. Some of the products distributed include planting materials, fruiting bags, fertilizers, gardening materials, Enriched Potting Preparation (EPP) and Simple Nutrient Addition Program (SNAP) kits, planting guides, dual composter and agricultural tool kits, compost bioreactor bins, compact impeller brown rice mill, and biomass shredder.

For the Gulayan sa Pamayanan, DOST National Capital Region (NCR) provided S&T-based livelihood and increased vegetable availability in metropolitan barangays by providing technical knowledge, skills, and establishment of community urban gardens.

The initiative was well accepted that the number of community beneficiaries increased from 7 to 19 barangays, covering 345 households. The kits provided enabled the beneficiaries to produce vegetables (e.g., lettuce, kangkong, eggplant, pepper, tomato, kale, 'saluyot,' and spring onion), herbs, and spices. A total of 922 participants were trained by experts from both the private and government agencies. One of the beneficiaries, which is Brgy. 412, Manila, recorded a P165,000 income from their communal garden.

A total of 2,698 participants registered during the Gulayan sa Pamayanan virtual presser. This was attended by the different stakeholders and was featured in Radyo Pilipinas and Radyo Agila.

The initiatives were expanded and are currently running in NCR, Region IV-A, and Region III. These offshoot projects diversify the community beneficiaries and the availability of S&T-based livelihood knowledge and skills offered by the Gulayan sa Pamayanan project.

Distribution of S&T packages during the LINGAP launch on July 30, 2021. (Image credit: SSU, DMMMSU, IfSU)

EPP kit distribution in Brgy. CAA, Las Piñas.

Photo during the EPP kit distribution in Brgy. 412, Manila.

Photo during EPP kit distribution in BF Homes, Parañaque

EPP training in Brgy. 412, Manila.

DOST-PCAARRD in the Regions

This component comprised the quick response projects (QRP) from different consortia based on the assessed needs to address COVID-19 concerns in the regions. A total of 11 new projects in seven regions were funded this year with a total investment of P32,193,196. As of December, this component has 18 completed and 19 ongoing projects with over 480 beneficiaries.

Rebuilding the Agriculture, Aquatic and Natural Resources in Response to COVID-19 (ReAARRC)

The program's R&D component has 15 approved projects, which includes projects on laboratory-reared seaweed, bamboo products, lapnis-framed face shields, bamboo-abaca disinfectant dispenser and foot bath, Darag native chicken, smoked tilapia and tilanggit, giant swamp taro chipping machine, geographic information system (GIS)-based system for production and utilization, Harmonizing Initiatives for R&D Advocacy in AANR (HIRAyA), coconut ethyl alcohol, ItikPINAS egg production, backyard tilapia farming, and soil health management.

Community-based Tablea Production for Sustainable Livelihood in Cotabato

To address the income loss of farmers and displaced workers from selected cacao-growing municipalities in Antipas, Tulunan, and Alcosan in Cotabato due to the pandemic, the University of Southern Mindanao (USM) designed and developed modules to train cacao farmers on cacao pre-processing and post-harvesting; USM tablea production, packaging, labelling, and marketing; enterprise management; and operational and sustainability plan. Each municipality also received 1 cacao grinder, 1 cacao sheller and winnower, 1 cacao roaster, 1 vacuum sealer, 1 cabinet, 15 trays, and other supplies for making tablea.

Bamboo-Abaca Hands-free Disinfectant Dispenser and Foot Bath Prototypes

The DOST-Forest Products Research and Development Institute (FPRDI) developed hands-free disinfectant dispenser and foot bath made from bamboo and abaca and distributed them to several establishments and government agencies in Los Baños, Laguna. These raw materials are more sustainable and ecological since the waste decomposition and pollution issues are lesser compared to plastic or metal-based products. Moreover, utilizing and promoting bamboo and abaca as raw materials for the manufacture of different products for the new normal will benefit local bamboo

The equipment received by each chosen municipality in Cotabato.

DOST-PCAARRD's Deputy Executive Director for R&D, Dr. Feliciano Calora, Jr., testing the bamboo-abaca hands-free disinfectant dispenser and foot bath.

DOST-FPRDI turns over the bamboo-abaca hands-free disinfectant dispenser and foot bath prototype to DOST-PCAARRD.

and abaca growers, processors, and small and medium entrepreneurs.

Mass Production and Distribution of Lapnis-framed Face Shields

In addition, DOST-FPRDI produced 700 lapnis-framed face shields, which were also distributed to agencies in Los Baños. Bent lapnis (*Broussonetia papyrifera* (L.) L'Herit ex Vent) wood showed that it is a good raw material to produce frames for face shields since it is lightweight, light-colored, and has good bending and machining properties.

Bamboo for Wellness Products

DOST-FPRDI likewise developed antimicrobial products from forest-based materials, which can help augment the prevention and protection of people against COVID-19. This included bamboo charcoal bar soaps, bamboo activated carbon bar and liquid soaps that were distributed in select regions in the country. Capacity building and skills training on bamboo hand soap making was also provided.

Project Field Testing of Laboratory-reared Seaweed Cultivars

Palawan State University-Marine Science Laboratory (PSU-MSL) provided supplemental livelihood to seaweed farmers who were affected by the Luzon lockdown in Mindoro, Marinduque, and Romblon. This also generated information on growth performance and quality of seaweed cultivars from PSU culture facilities.

Eleven fast-growing seaweed cultivars from the indoor laboratory of PSU were sea-out planted to sea-based nursery in Barangay Sandiwa, Puerto Princesa Bay. Of these, six cultivars with an

DOST-FPRDI turns over the lapnis-framed face shields to DOST-PCAARRD.

Developed bamboo for wellness products.

estimated weight of 100 kilograms (kg), were successfully mass propagated and selected for field-testing in the established experimental plots in selected areas of Roxas and Taytay, Palawan. To date, a total of 445 kg seedlings from the experimental plots were dispersed. Furthermore, at least 474 seaweed farmers and technical staff from municipal agriculturist offices from eight municipalities in Region IV-B benefited from the training on "Seaweed Farming Technologies and Business Enterprise."

Promoting Private Sector-led Commercial Scale Production of ZamPen Native Chickens in Zamboanga Peninsula

This initiative by the Josefina H. Cerilles State College-Dumingag Campus and Western Mindanao State University (WMSU) aimed to increase food production in communities during health emergencies such as pandemics and calamities. Seventeen farmer adoptors from Zamboanga del Sur, Pagadian City, Ozamis City, Camiguin, Lanao del Norte, and Davao City were assisted to engage in breeding and production of ZamPen native chickens on a commercial scale. From their initial stocks of 777 head (hd), the farmers were able to increase their total inventory to 2,732 hd of breeder ZamPen chickens. They have already sold 4,865 hd of day-old and hardened chicks, as well as slaughter chickens.

Reformation Program for Persons Deprived of Liberty in New Bilibid Prison

The program aimed to augment the availability of food, particularly chicken meat and eggs, within the New Bilibid Prison (NBP) and to reform persons deprived of liberty (PDL). In March, a series of trainings on broiler and layer chicken production and management was conducted benefiting both PDL and Bureau of Corrections (BUCOR) personnel. Three cycles of broiler production were completed. A total of 5,400 broiler chickens were raised for 32–35 days per cycle producing a total of 7.1 tons (t) of live broiler chickens from August to December. These were marketed within the NBP.

The PDL were also engaged in layer chicken production. They managed 390 layer chickens, which started laying eggs in September and are currently at their peak of performance (more than 90 percent [%]). Daily harvest of 360 fresh eggs are sold to BUCOR personnel and to other NBP security camps as their daily food supply.

Smart Food Value Chain

This component has 11 approved smart food value chain projects that have already produced native chicken meat, tilapia, and strawberries. Two hundred sixty-two farmers were also trained, supporting 102 farm enterprises.

ZamPen native chicken breeder growers.

PDL benefited from the reformation program.

DOST'S Eleven-Point Agenda

In support to the achievement of the DOST's vision and delivery of its identified outcomes, the Council employed different strategies identified by the Department known as the DOST's Eleven-Point Agenda.

The only DOST agenda not applicable to DOST-PCAARRD is Agenda 8: Expand STI assistance to communities and the production sector, particularly the micro, small and medium enterprises (MSMEs). The Council ensured that the 10 strategies are feasible and applicable to all the ISPs being implemented by its partners.

The following are the Council's significant contributions and accomplishments under each agenda.

Agenda 1: Pursue R&D to Address Pressing National Problems

Bamboo Textile

The construction of the Bamboo Textile Fiber Innovation Hub at Terra Verde Ecofarm in Maragondon, Cavite is part of DOST-Philippine Textile Research Institute's (PTRI) project to house the improved bamboo extraction machine. The PTRI-developed technology on the extraction of bamboo textile fibers not only provides diversification to bamboo utilization, but also provides a more environment-friendly process to extract bamboo textile fibers. Moreover, the bamboo textile innovation hubs that will be established throughout the country will localize bamboo textile fiber supply and bamboo fiber extraction methodologies per region with abundant bamboo plantations, while fostering employment in local communities.

Bayog pole.

Raw bayog fibers.

Treated bayog fibers.

Bayog blended yarns (final product).

Conservation and Sustainable Development of Biodiversity in Selected Mountain Ecosystems of Mindanao

Central Mindanao University (CMU) developed strategies on forest protection and biodiversity conservation for Mount (Mt.)Apo, Hamiguitan, Pantaron, and Tago. The strategies ranges through intensive resource assessments, inventory and mapping, and socio-cultural services assessment. Critically endangered plants endemic to the Philippines were found which includes the *Paphiopedilum adductum* Asher and *Paphiopedilum ciliolare* (Rchb. f) Stein as well as new possible species such as the *Corybas* sp., *Diclochia* sp., and *Hypericum* sp.

Possible new species of flowering plants: *Corybas* sp. (left), *Diclochia* sp. (middle), and *Hypericum* sp. (right).

Critically endangered plant, *Paphiopedilum adductum* Asher.

ProvitB1 as Aquafeed for Tilapia and Milkfish

The University of the Philippines Visayas-National Institute of Molecular Biology and Biotechnology (UPV-NIMBB) conducted a feeding trial where benfotiamine was supplemented in the tilapia's diet. Benfotiamine is a derivative of Vitamin B1 (Thiamine), which improves carbohydrate utilization in diabetic human subjects. Since most, if not all, aquatic animals are variably unable to utilize high dietary carbohydrates, adding benfotiamine to fish diet is hypothesized to make feeds cheaper by replacing a considerable amount of dietary proteins with carbohydrates. The study found that growth, efficiency of nutrient utilization and whole body lipid, and protein deposition in both tilapia and milkfish were better in groups fed dietary benfotiamine than those with no supplementation. When examined at the molecular level, dietary benfotiamine hastened the process of breaking down carbohydrate and its products inside the fish's body compared with those that were fed with no benfotiamine supplementation.

Pilot tests were done in fishpond cages to document the growth performance of both Nile tilapia and milkfish and their profitability when benfotiamine was added to a high carbohydrate diet. The tests showed increased profits of P232.46/cage for tilapia and P149.56/cage for milkfish.

Potential of the Naujan White Goby ('Biyang Puti') for Aquaculture

To address the declining population of the Naujan white goby, the Mindoro State University (MinSU) researchers explored the aquaculture potentials of Naujan Lake goby. Preliminary data with the use of geometric morphometrics showed site specificity of the shape of the fish suggesting either genetic differentiation or environmental plasticity. Environmental factors that may affect this may include nutrient fluxes and salinity levels. The significant differences in shape of the species is also apparent with the initial data from five other lakes around the Philippines. Validation of initial biological data showed a bimodal trend in reproductive cycle, optimum 20,000 eggs per female, and opportunistic feeding behavior. Using these initial data, the team laid out the criteria on selecting broodstock for aquaculture to conserve genetic resources and enhance species' commercial potential. Stocks harvesting should be site-specific, and at least 14.2 centimeters (cm) in length to ensure sexual maturity. The project has so far presented three papers and linked with three research institutions to further develop the aquaculture technology for the species.

Doctor (Dr.) Augusto E. Serrano (center), project leader from UPV together with Mr. Barry Leonard Tumbukon (left), research assistant, and Engineer (Engr.) Eduardo V. Manalili (right) at the pilot testing area where benfotiamine is incorporated in the diet of Nile tilapia.

Catching of biyang puti in Naujan Lake to be used for morphometric and genetic studies.

First Successful Ex-situ Captivity of the Endangered *Sardinella tawilis*

The University of the Philippines Los Baños-Limnological Station (UPLB-LS) has successfully kept the endangered *Sardinella tawilis* alive in captivity for the first time. The project developed protocols for the collection, transport, and initial rearing to determine the possibility of ex-situ captivity as a conservation measure. A total of 10 collection, transport, and initial rearing trials for *S. tawilis* were conducted from July 2020 to May 2021. A modified beach seine-net was identified as the best method for collection of tawilis. Transport protocols which yielded the highest survival use 1,000-liters (L) transport tanks with continuous aeration. The use of 3-t capacity circular, collapsible tanks with recirculating systems were found suitable for the culture of tawilis. Captivity trials showed that *S. tawilis* lasted about 27 hours in on-site ex-situ housing while approximately 28% of individuals survived after 30 days in off-site ex-situ captivity. Suitable water quality conditions and appropriate live feed were determined. The optimal values of the following water quality parameters for the survival of tawilis during initial rearing were established (Table 1).

Conductivity was found to have the greatest influence on survival in captivity. In addition, the combination of both conductivity and dissolved oxygen significantly affected off-site survival of *S. tawilis*. *S. tawilis* can also be fed with *Daphnia magna* and *Moina* sp.

Table 1. Optimal values of water quality parameters for tawilis' survival during initial rearing.

Water Quality Parameters	
Temperature	27–28°C
Dissolved oxygen	greater than 5 mg/L
Salinity	1.6 ppt – 1.8 ppt
pH	8.0-8.6
Ammonia level	less than 1mg/L
Stocking density	0.02 ind./l

Capturing tawilis from Taal Lake to be used for transport and ex-situ rearing experiments.

Tawilis kept in captivity in a fiberglass tank.

Live coloration of *Sardinella tawilis*.

Intermediate 1,000-L bulk containers loaded on an open-back truck being filled with lakewater via a submersible water pump.

Housing tank in UPLB-LS. Note the black mesh netting on the top of the tank covering the setup to prevent escape of *S. tawilis*.

Loop-mediated Isothermal Amplification Detection Kit for Acute Hepatopancreatic Necrosis Disease in Shrimps

The University of Santo Tomas developed a Juan Amplification (JAmp)-AHPND diagnostic kit, a LAMP-based, rapid detection platform for acute hepatopancreatic necrosis disease in shrimps. The name is shorthand for Juan Amplification and emphasizes the kit's main features: a Philippine-made detection tool that can amplify target viral DNA using one amplification temperature and give results in 1 hour. The kit was designed to be an on-site detection platform that serves as an alternative for the more common polymerase chain reaction. It requires a two-step process, which includes the extraction of the target DNA and the LAMP reaction. The extracted bacterial DNA from the shrimp tissues will then be used in the LAMP assay.

Currently, a total of 13 new generations of heat block machines were fabricated. These easy-to-operate machines were designed to maintain the required temperature for the LAMP assay. In the new generation heat block, the viewer or the blacklight is placed at the front of the machine to enable the users to easily view the results. Another unique feature of the new model are the customizable temperature and time controls, making it applicable to detect a wide variety of diseases. Also, it includes switching from a 100-watt (W) to a 250-W heater to improve temperature specificity and add plastic base stands for better ventilation.

A total of nine kits were turned over to nine adoptors in Luzon and Visayas.

JAmp detection kit components.

New generation heat block machines.

Biofloc Technology in the Nursery Production of *Penaeus vannamei*

To address the decreasing shrimp production and adapt to the fast-evolving demands of the new normal, the University of San Agustin and the Marmi Agricultural Corporation developed a biofloc technology (BFT) protocol for the tank-based nursery production of white leg shrimp (*P. vannamei*). The BFT uses a microbial mat composed of aggregates of bacteria, algae, protozoa, detritus, and dead organic particles that help control natural microbial activity, providing natural food for the shrimp larvae and maintaining optimum water quality through recycling nitrogenous wastes into more useful forms.

In experiments using BFT in small, circular tanks, data showed that shrimps attained an average body weight of 1.26 grams (g), a survival rate of 100%, and a feed conversion rate of 0.43. The different water quality parameters were maintained within the optimum levels required for shrimp growth. It was also observed that the Vibrio populations were lower in the biofloc groups compared with the non-biofloc. These results indicate that the use of small, circular tanks with biofloc during the nursery production phase is feasible and can be incorporated in the grow-out culture. The industry collaborator can further increase their stocking cycles from 5–6 to 8–10 times per year which will later improve their shrimp production.

Circular nursery tank setup at Marmi Agricultural Corporation, Silay City, Negros Occidental.

Probiotics application during the nursery culture *P. vannamei*.

Harvested *P. vannamei* cultured using Biofloc Technology.

Assessing the Status of Giant Clams and Advancing Culture Techniques

Genomic Approaches to Support Giant Clam Mariculture and Conservation

The University of the Philippines-Marine Science Institute (UP-MSI) generated the first transcriptome assemblies for all the eight giant clam species found in the Philippines and for the first time described the unique structure of the giant clam 28S rRNA genes. Common or unique genes to each of the species revealed a comprehensive picture of the genes that are important for growth, development, survival, and stress tolerance. Genes involved in neurotransmitter signaling in controlling the transition of larvae into juveniles of two giant clam species were also observed. These genetic resources and information may be harnessed to improve giant clam survival in culture, increase mariculture yield, and develop tools for monitoring giant clam populations in reefs. These findings bolster ongoing conservation efforts by contributing to our understanding of how giant clams can adapt to survive in a rapidly changing ocean environment.

Preparing for giant clam spawning to collect gametes for culture experiments.

Observing developing giant clam larvae from the experiments.

Inspecting giant clams grown in culture after several months.

Giant Clam Conservation Bright Spots in Mindanao: Status of Giant Clams and Its Implications to Conservation and Governance

The project of Davao del Norte State College showed the positive impacts, both in terms of biological and socio-economic benefits, of giant clam restocking sites in Mindanao. The sites in Camiguin and Samal Islands strongly indicated that restocked clams are able to supply larvae to adjacent reef areas. Both areas emerged as sustainable ecotourism sites on giant clams and serve as a source of livelihood for the coastal communities.

A Call to Protect Giant Clams in Palawan

Studies conducted by the Western Philippines University (WPU) showed that the highest densities of giant clams were observed at a few well-managed reserves and that the presence of giant clam juveniles suggests that local recruitment is successful in some sites. Information dissemination activities were conducted to feedback the results, increase awareness of giant clam conservation, and encourage continuous restocking activities in Taytay, Port Barton, Binduyan, Narra, Brooke's Point, Puerto Princesa, Zamboanga State Colleges, Malampaya Foundation, Inc. and Protected Area Management Board. This will hopefully trigger the development of local policies and increase vigilance on the illegal harvesting of giant clams in Palawan. As initial response, the Malampaya Foundation, Inc. forged a partnership with the WPU in in situ induced spawning, nursery rearing, and restocking of giant clams. At present, there is an ongoing restocking of hatchery-produced *Tridacna squamosa* and *Tridacna gigas* in six localities in Palawan.

***Tridacna gigas* recruits.**

Natural spawning.

Giant clam ecotourism in Samal Island, Mindanao.

Confirmed presence of *T. gigas*.

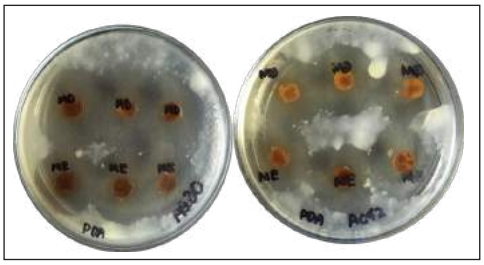
IEC activities and feedbacking to assessment sites.

Pilot Testing of ACTICon™ as Biocontrol Agent against Fusarium Wilt (Foc TR4) in Cavendish Banana

Fusarium oxysporum f. sp. Cubense is a fungus that lives in the soil and attacks the plants from the roots. It stays in the soil for decades, making the land unusable for non-resistant crops. Tropical Race 4, the strain that attacks the current Cavendish variety can cause 100% mortality rate and yield loss. Spearheaded by UPLB, a new biocontrol formulation, branded as ACTICon™ was developed to address this problem. This biocontrol agent enhances plant growth, lowers infection brought about by Fusarium wilt, and improves fruit yield.

ACTICon™-treated meriplants had a higher survival rate of 97.49% compared with the 72.1% survival rate of untreated meriplants. Cavendish bananas (Grand Nain variety) planted in an abandoned and heavily Fusarium wilt-infected farm in Asuncion Davao del Norte, had high survival rate at 94.91%. Fruiting was higher in ACTICon™-treated Cavendish which yielded 30.32 tons/hectare (t/ha) at 15 months after transplanting compared with only 14.17 t/ha in untreated plants. In Sto Tomas, Davao del Norte, the effects of ACTICon™ was enhanced with the addition of complete fertilizer. Plant height and girth improved and infection rate was low at only 16.66%. A total yield of 351.54 kg, at 15 months after transplanting, was harvested.

Actynomycetes in ACTICon™ formulation. (Image credit: UPLB-BIOTECH)



Agar plug assay of AQ30 (left) and AC42 (right) grown in malt extract and maltodextrin exhibiting zones of inhibition against Fusarium. (Image credit: UPLB-BIOTECH)

Early fruiting and disease-free ACTICon™-treated Cavendish bananas. (Image credit: UPLB-BIOTECH)

ACTICon™-treated meriplants are taller and have better root system. (UPLB-BIOTECH 2021)

Grand Nain variety of Cavendish banana treated with ACTICon™. (UPLB-BIOTECH 2021)

Private Sector Uses R&D Outputs to Build ItikPINAS Enterprises

Since 2017, the R&D program of DOST-PCAARRD on ItikPINAS developed two purelines IP-Itim and IP-Khaki and the commercial hybrid line IP-Kayumanggi. It also promoted and distributed IP-Kayumanggi ducks and drakes to farmer cooperators across seven regions. Many rural enterprises emerged to engage in the commercial production of hatching eggs and day-old ducklings as this commercial line can produce 266 eggs per duck in a year with consistent product quality.

In 2021, private sector adoptors have increased and made the IP-Kayumanggi hatching eggs and day-old ducklings available in Zaragoza, Nueva Ecija; Candelaria, Quezon; Calamba, Laguna; Iloilo City; Trento, Agusan del Sur; Compostela Valley; and Zamboanga City. Evidently, these entrepreneurs income increased by P462/duck per year. Moreover, the private ItikPINAS farm in Zaragoza, Nueva Ecija was currently named a beneficiary of DOST's "Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Program" that is geared to ensure sustained availability of ItikPINAS in Central Luzon.

Farmers' Associations Adopt and Earn from Native Chicken Technology

Following the footsteps of the Panay Darag Chicken Breeders Association Inc., the ZamPen Native Chicken Growers Association of Zamboanga also banded as a group and formed and registered their association on November 20 with an initial membership of 19. Their mission is to create a sustainable livelihood out of ZamPen chickens through R&D introduced by the DOST-PCAARRD project.

They are led by Mr. John Apolinario, who raises over 1,000 ZamPen chicken heads. With the assistance from the WMSU College of Agriculture Technology Business Incubation Program; Western Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium (WESMAARRDEC); and Research Extension and External Linkages Research Development and Evaluation Center (RESEL-RDEC), the association sold 2,806 ZamPen day-old chicks and slaughter chickens. Currently, their group is recruiting members from ZamPen native chicken adoptors from Zamboanga del Norte, Zamboanga Del Sur, and Zamboanga Sibugay and planning to elect officials to represent other members from the Zamboanga Peninsula Region.

ZamPen native chicken.

Biosecurity Protocols towards Q-Black Repopulation

In July 2019, the first case of African Swine Fever (ASF) was recorded in the country, without an effective ASF vaccine available, strict and effective biosecurity protocols key to preventing the virus from entering and spreading in pig farms. With this information in mind, native pig researchers were trained to implement strict and enhanced biosecurity protocols against ASF, which resulted in a successful repopulation of the native pig Q-Black strain in the DA-Bureau of Animal Industry's National Swine and Poultry Research and Development Center (NSPRDC). NSPRDC is one of the DOST-PCAARRD-supported native pig research stations, which was previously hit by ASF. Currently, the NSPRDC has a total inventory of 150 hd and continues to produce breeder and slaughter Q-Black native pigs to cater to the industry's need for breeder and lechon pigs.

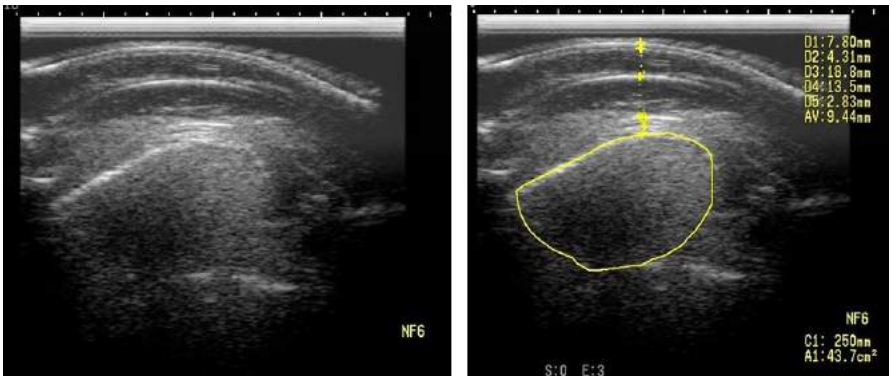
DNA Marker Selection and Meat Quality Assessment Protocols for Philippine Native Pigs and Beef Cattle

A non-invasive scanning protocol to evaluate marbling, loin eye area, muscle depth, and back fat thickness in native pigs has been developed by the Philippine Carabao Center (PCC) in Muñoz, Nueva Ecija thru the use of a real-time ultrasound scanner. The initial results showed that more than 50% of the samples tested are carriers of Heart Fatty Acid Binding Protein or H-FABP gene, specifically the HinfI and HAEIII genotypes, which are associated with intramuscular fat or marbling. This indicates that marbling in the meat is a natural trait of the Philippine native pig and somehow provides the basis for the claims that the native pig lechon is tastier and more flavorful than lechon made from a commercial hybrid.

For beef cattle, initial results showed that the 276 sampled animals have been genotyped for three genes which are associated with marbling that makes up the strong flavor or taste in beef called 'titin' and meat tenderness such as calpastatin, ddel and calpastatin, Sse9I.

Q-Black piglets on range at NSPRDC Native Pig Farm.

Ultrasound scanning to determine native pig meat quality without slaughtering them.



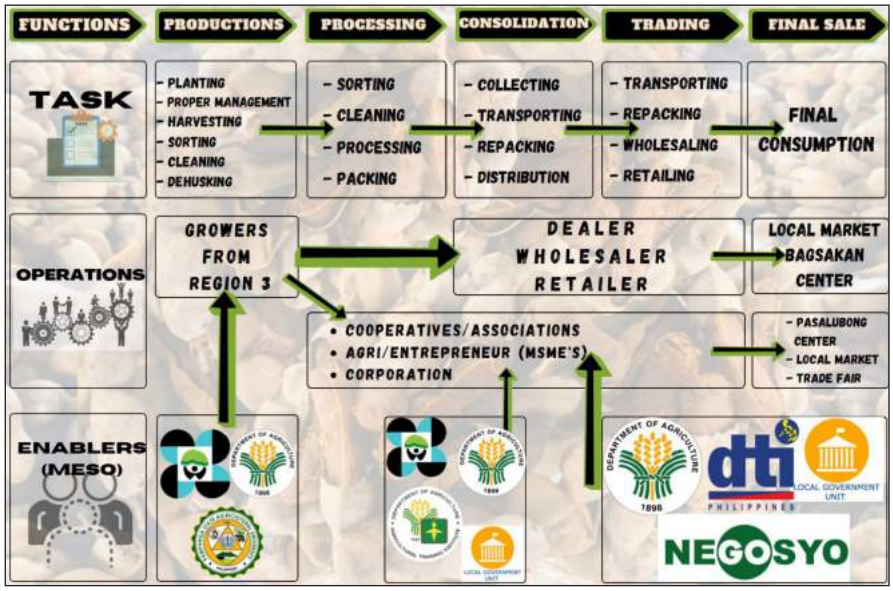
Ultrasound image of native pig meat.

Agenda 2: Conduct R&D to Enhance Productivity and Improve Management of Resources

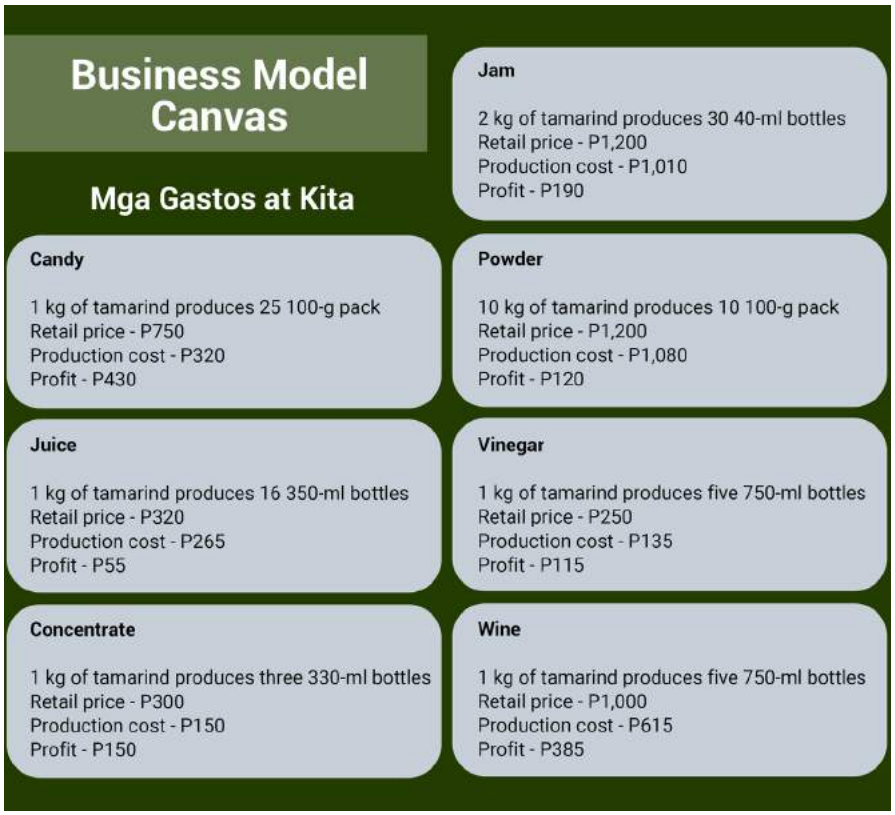
Value Chain Analysis and Marketing of Tamarind

Using the information on the tamarind industry in Central Luzon generated through value chain analysis, Pampanga State Agricultural University (PSAU) developed a value chain map and business model on tamarind product processing and identified processed products with business potential such as candy, juice, concentrate, jam, powder, wine, and vinegar. Thirteen tamarind growers in Guimba, Nueva Ecija were linked with a retailer in Cabanatuan, Nueva Ecija. Moreover, 73 growers in Bulacan and Pampanga were trained on marketing strategies. Three IEC materials with the following titles were developed: “Mga Produkto mula sa Sampalok,” “Sour Tamarind," and “Sweet Tamarind" brochures.

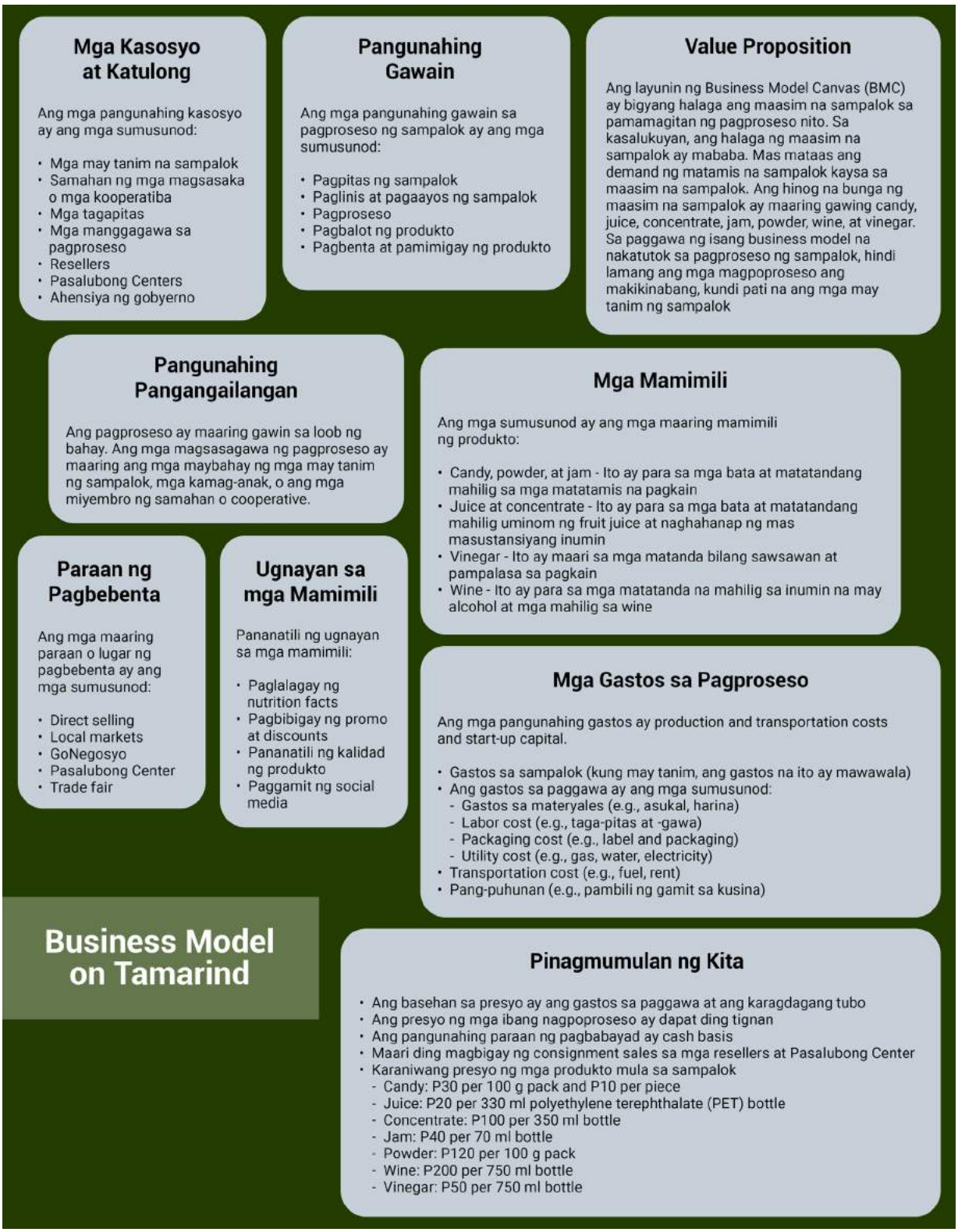
The project is under the program titled, "DOST’s Accelerated R&D Program for Capacity Building of R&D Institutions and Industrial Competitiveness."



Value chain map of tamarind. (Image credit: PSAU)



Business model canvas on tamarind product processing. (Image credit: PSAU)



Business model on tamarind product processing. (Image credit: PSAU)

PSAU researchers interview sellers of sour tamarind at Sta. Ana Public Market, Sta. Ana, Pampanga. (Image credit: PSAU)

'Bagsakan' center in Vergara Highway, Cabanatuan City, Nueva Ecija. (Image credit: PSAU)

Tamarind products. (Image credit: PSAU)

Documentation of Indigenous Vegetables in the Philippines

UPLB, SUCs, and local and provincial governments in 20 provinces, namely Abra, Batangas, Bohol, Bukidnon, Camarines Sur, Capiz, Davao del Sur, La Union, Leyte, Ilocos Sur, Ilocos Norte, Iloilo, Nueva Ecija, Nueva Vizcaya, Quezon, Siquijor, Rizal, South Cotabato, Surigao del Sur, and Zamboanga del Norte, assessed the diversity and explored the uses of indigenous vegetables to improve their utilization in the country. Indigenous vegetables are crops usually grown by natives, but are not cultivated on a large scale, hence, they are underutilized and often overlooked, even if they could serve as good sources of food, nutrients, and income. A total of 145 indigenous vegetables belonging to 90 families were documented. To raise awareness and promote the indigenous vegetables, 20 popularized pamphlets on indigenous vegetables were developed for nationwide dissemination. To store and maintain information on indigenous vegetables, a book is currently being packaged and an information system is being developed.

A child gathering edible fiddlehead fern (*Athyrium esculentum*) commonly known as 'pako' in Maazin, Quezon, Nueva Vizcaya. (Image credit: ICropS-UPLB)

A farmer gathering 'pajaw' (*Schismatoglottis* sp.) in Agsam, Lanuza, Surigao del Sur. (Image credit: ICropS-UPLB)

Farmers in Agpay, Burgod, La Union preparing gabi (*Colocasia esculenta*). (Image credit: ICropS-UPLB)

Long Staple Processing of BANDALA/Lyocell Fiber for Philippine Tropical Fabrics

DOST-PTRI conducted long staple processing of natural fibers blended with lyocell for the production of Philippine Tropical Fibers (PTF). The fiber treatment of the raw BANDALA fibers using the degumming machine was completed during the project's first year of implementation. Fibers were then blended using the carding machine. The lyocell/BANDALA spun yarns with blend ratio of 60/40, 50/50, and 40/60, and pure lyocell spun yarns were prepared for natural dyeing and consequently for colorimetric property determination. Weavers Textile Mills, Inc. employed a twill weave design for the medium-weight fabrics. The findings will hopefully redound to the full implementation of Republic Act (RA) 9242, which prescribes public officials and employees to use PTF uniforms.

Raw BANDALA fibers. (DOST-PTRI 2021)

Treated textile BANDALA fibers. (DOST-PTRI 2021)

Lyocell/BANDALA spun yarns.

Lyocell/BANDALA slivers.

Carding machine. (DOST-PTRI 2021)

Pure lyocell spun yarns.

Mechanical blending of BANDALA textile fibers and lyocell fibers using the carding machine.

Reeled and pure lyocell/BANDALA spun yarns.

Dyed lyocell/BANDALA yarns.

Lyocell/BANDALA blended power loom fabrics with 40/60 blend.

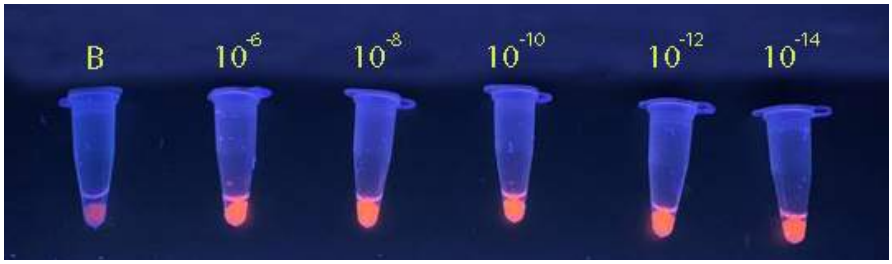
Lyocell/BANDALA blended power loom fabrics with 60/40 blend.

Lyocell/BANDALA blended power loom fabrics with 50/50 blend.

LAMP Kits for Mango Diseases

Under the DOST and Japan Society for the Promotion of Science (JSPS) Joint Research Program, the Polytechnic University of the Philippines (PUP) in collaboration with Mie University in Japan developed the PUP Detect or LAMP detection assay for the detection of mango diseases including anthracnose and stem-end rot. The kits can detect the presence or absence of the causal pathogens of the said diseases even without visible symptoms as the causal pathogens cause latent infection. The kits are envisioned to benefit mango growers, researchers, quarantine personnel, and policymakers as these were intended to be used for phytosanitary measures. As part of capacity building, two project staff were trained on the protocol for primer design at Mie University, while a total of 26 Bachelor of Science (BS) in Chemistry and BS Biology students from PUP were trained on pathogenicity and LAMP testing. Three Master of Science (MS) students were involved in the project, one of whom is a scholar under the DOST-PCAARRD's GREAT program.

LAMP kits for detection of anthracnose (top) and stem-end rot (bottom) diseases of mango developed by the Polytechnic University of the Philippines under the project, "DOST-JSPS Joint Research Program: LAMP Detection Assays for Anthracnose, Stem-End Rot and Scab Disease Pathogens in Philippine 'Carabao' Mango." (Image credit: PUP 2021)



Sensitivity and specificity testing of *Colletotrichum* LAMP Assay. (Image credit:PUP 2021)

Training on pathogenicity testing. (Image credit:PUP 2021)

Nano-biosensor Technology in Disease Surveillance and Diagnosis of Economically Important Crops

The De La Salle University (DLSU) developed a prototype diagnostic kit in two separate systems: electrochemical and colorimetric. The electrochemical system can quantify the pathogen load in the sample; whereas, the colorimetric system can identify the presence or absence of the pathogen. The team designed probes for the detection of Panama disease and bunchy top in banana, late blight in white potato, bacterial wilt in tomato, and Rugose Mosaic Virus in potato.

Colorimetric detection which will also be applicable with other causal organisms in other crops was done first on tomato. The results of the colorimetric detection using nanogold particles and thiolated probes of bacterial wilt in tomato due to *Ralstonia solanacearum* motility gene demonstrate the potential of the method to detect the pathogen in infected plants and its capability to differentiate the disease caused by *R. solanacearum* from other fungal pathogens. However, further optimization and validation of the detection method are still recommended to fully realize its potential.

Optimization of Production and Use of FertiGroe® Nanofertilizers

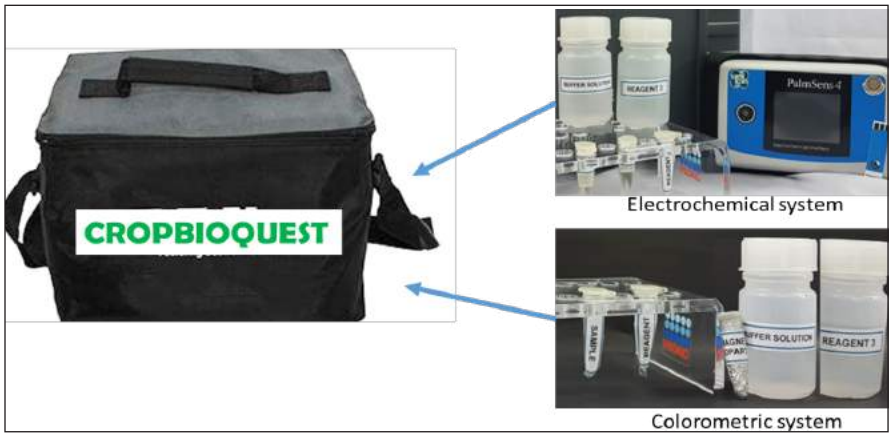
UPLB tested the use of FertiGroe® nitrogen (N), phosphorus (P), and potassium (K) nanofertilizers on rice, corn, eggplant, cabbage, potato, sugarcane, coffee, cacao, and banana. The use of FertiGroe® nanofertilizers reduced fertilizer application by as much as 50%, and produced higher net profit and yield compared with using conventional fertilizers.

The following recommended rates of the FertiGroe® nanofertilizers were observed to be at par or better with a 50% increase in yields in corn, rice, cabbage, and cacao; 100% in eggplant; 55% in sugarcane; 37.5% in coffee; and 75% in banana. This resulted in an increased net profit of 20% for corn, 40% for rice, 58% for eggplant, 46% for cabbage, 5% for potato, and 103% for sugarcane.

Test results showed that using FertiGroe® nanofertilizers increased coffee berry yield by 104% and cacao pod yield by 106%. Moreover, labor costs were reduced and yields increased, which provided an additional income to coffee and cacao growers. With one year application of FertiGroe® nanofertilizers, it provided the coffee and cacao growers a net profit of P20,000.

In banana, FertiGroe® nanofertilizers increased the number of hands per bunch in 'saba' and reduced the amount of rejects in Cavendish, thereby increasing the marketable yield for saba by 22% and Cavendish by 24%.

The patent for FertiGroe® N, P, and K nanofertilizers has already been applied for registration with the Fertilizer and Pesticide Authority.



Prototype of the nanodiagnostic kit. (DLSU 2021)

Fertilizer application in selected coffee trees. (UPLB 2021)

Green Packaging for Rice and Other Commodities

Iloilo Science and Technology University (ISAT-U) developed a process for converting agricultural wastes into green packaging for rice and other commodities. Among the different combinations of rice straw, banana stem, corn husk, and bagasse and wood fibers, the banana stem-rice straw combination (1:1 ratio) has the highest pulp yield (62.35%), tear strength (314.7 gram force), and tensile strength (8.975 kilonewton per meter [kN/m]).

The process of developing green packaging consisted of three major steps: 1) pulping process, 2) hand sheet making process, and 3) packaging design process. Applying carrageenan extract as an internal sizing agent prior to sheet forming enhanced the paper's wet strength and the packaging's antibacterial function. Coating the paper with chitosan produced from waste shrimp shells decreased the paper sheets' water absorbency from 360.32 grams per square meter (g/m^2) to 42.24 g/m^2. However, using chitosan is not cost-effective for small-scale production of packaging materials. The developed packaging material is food grade and chemical-free. It also preserves rice products longer. It has similar color and texture as the light brown recycled kraft paper.

A mechanical beater that beats and refines the pulp and mixes up to 20 L of pulp slurry was also developed. The Calatrava black rice produced by Zarraga Integrated Diversified Organic Farmers Association was used to test the developed packaging material.

Integrated Pest Management (IPM) for Broccoli and Strawberry Grown in Different Production Systems Under Protected Structures

The Benguet State University (BSU) studied the effects of different IPM strategies on the major diseases of broccoli (Table 2) and strawberry (Table 3) grown with organic and good agricultural practice (GAP) production systems under a protected structure. The results are summarized in Tables 2 and 3.

A step in paper sheet making.

Packaged rice using the developed packaging.

Extracts of nucleopolyhedrosis virus (a), (b); infected larvae (c), (d); and mulberry leaves (e), (f) dipped in nucleopolyhedrosis virus (NPV) extract for mass production.

Symptoms of *Alternaria brassicae* on broccoli leaf (left) and broccoli florets (right).

Microscopic conidia of *Alternaria brassicae* at 400x.

Table 2. IPM strategies on the major diseases of broccoli.

Disease	IPM Strategy	
	Organic production system	GAP production system
Black rot *(Xanthomonas campestris)*	Application of botanicals (BSU GAP) and biocontrol agents (BCA) *Trichoderma koningii* provided more effective control in terms of lower disease infection and higher percentage disease control.	Application of green label fungicide and BCA *T. koningii* decreased the infection severity and provided higher percentage of disease control. The effectiveness of the BCA *T. koningii* is caused by the antagonism and formation of toxic substances by fungi affecting the growth and multiplication of the bacteria *Xanthomonas campestris.*
Alternaria leafspot *(Alternaria brassicae)*	Application of botanicals (BSU GAP) and BCA *T. koningii* resulted in lower disease infection and higher percentage disease control.	Application of green label fungicide resulted in lower disease infection and higher percentage disease control.
Clubroot *(Plasmodiophora brassicae)*		Application of BCA *T. koningii* was most effective in terms of less disease severity and higher percentage disease control. The effectiveness of the BCA *T. koningii* is caused by the antagonism and formation of toxic substances by the fungi affecting the growth and multiplication of the fungal-like *P. brassicae.*

Table 3. IPM strategies on the major diseases of strawberry.

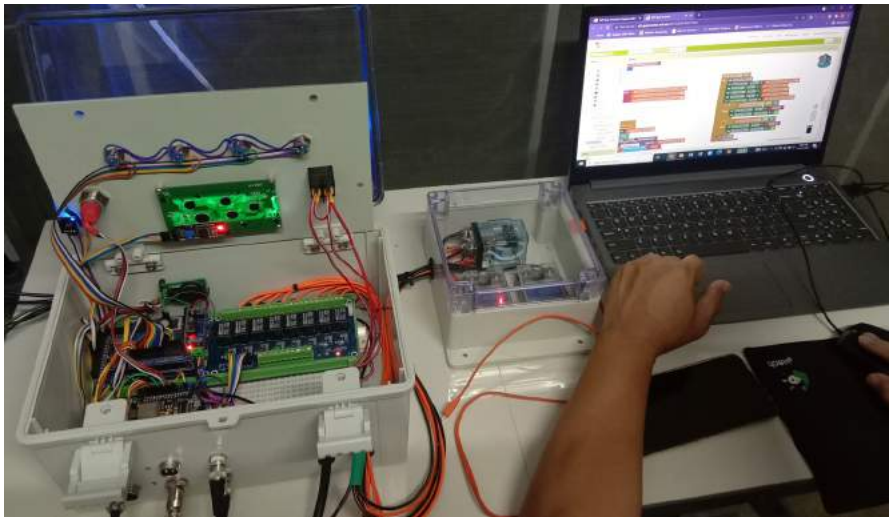
Disease	IPM Strategy	
	Organic production system	GAP production system
Leaf spot *(Mycosphaerella fragariae)*	Application of BCA *T. koningii* + entomopathogenic nematodes (EPN) and biofungicide with *Bacillus subtilis* as active ingredient provided more effective control in terms of lower disease infection and higher percentage disease control.	Application of botanicals (fermented fruit juice + Perla soap), BCA *T. koningii* + EPN, and biofungicide resulted in lower disease infection and higher percentage control.
Fusarium rot *(Fusarium oxysporum)*	Application of BCA *T. koningii* + EPN and green label fungicide decreased infection severity and provided higher percentage disease control. In addition, the application delayed the leaf spot's infection.	Application of BCA *T. konongii* + EPN and green label fungicide provided better percentage disease control resulting in lower disease infection and delayed disease.

Management of Unified Control and Automated System for Smarter Greenhouse Hydroponics

ISAT-U's locally-developed smart greenhouse hydroponics through the "DOST-CRADLE Program" has benefitted the Ephrathah Farms, Inc. in Badiangan, Iloilo. This project applies the internet of things (IoT) technologies to automate the monitoring and control of growth parameters of lettuce grown in a nutrient-film-technique hydroponics system.

The smart greenhouse hydroponics is equipped with sensors and communication technologies that automatically capture data on essential parameters such as temperature, acidity or pH, electrical conductivity, and water flow. The collected data goes through an IoT platform for monitoring, analysis, and control. Aside from monitoring from a personal computer, the use of an Android application enables a farm manager to remotely monitor the system's status or control specific actuators for water flow, fertigation, and water cooling. Moreover, it is powered by solar energy; making its energy requirement low.

According to Ephrathah Farms, Inc. Manager Engr. Ed Roderick V. Cañuto, the system's efficiency helps him monitor the greenhouse with his mobile phone even during wee hours and in the middle of the night.



ISAT-U-developed smart management system, consisting of hardware component with associated firmware that is capable of controlling and maintaining desired water parameters necessary for lettuce growth and production.

A sensor device setup inside the greenhouse to monitor humidity and temperature conditions.

The ISAT-U and Ephrathah Farms research team composed of (left to right) Hilario S. Taberna Jr., Engr. Ed Roderick V. Cañuto of Ephrathah Farms, Inc., Vanessa Mae D. Supapo, and Renerio S. Mucas during the smart management system for hydroponics in a greenhouse tryout.

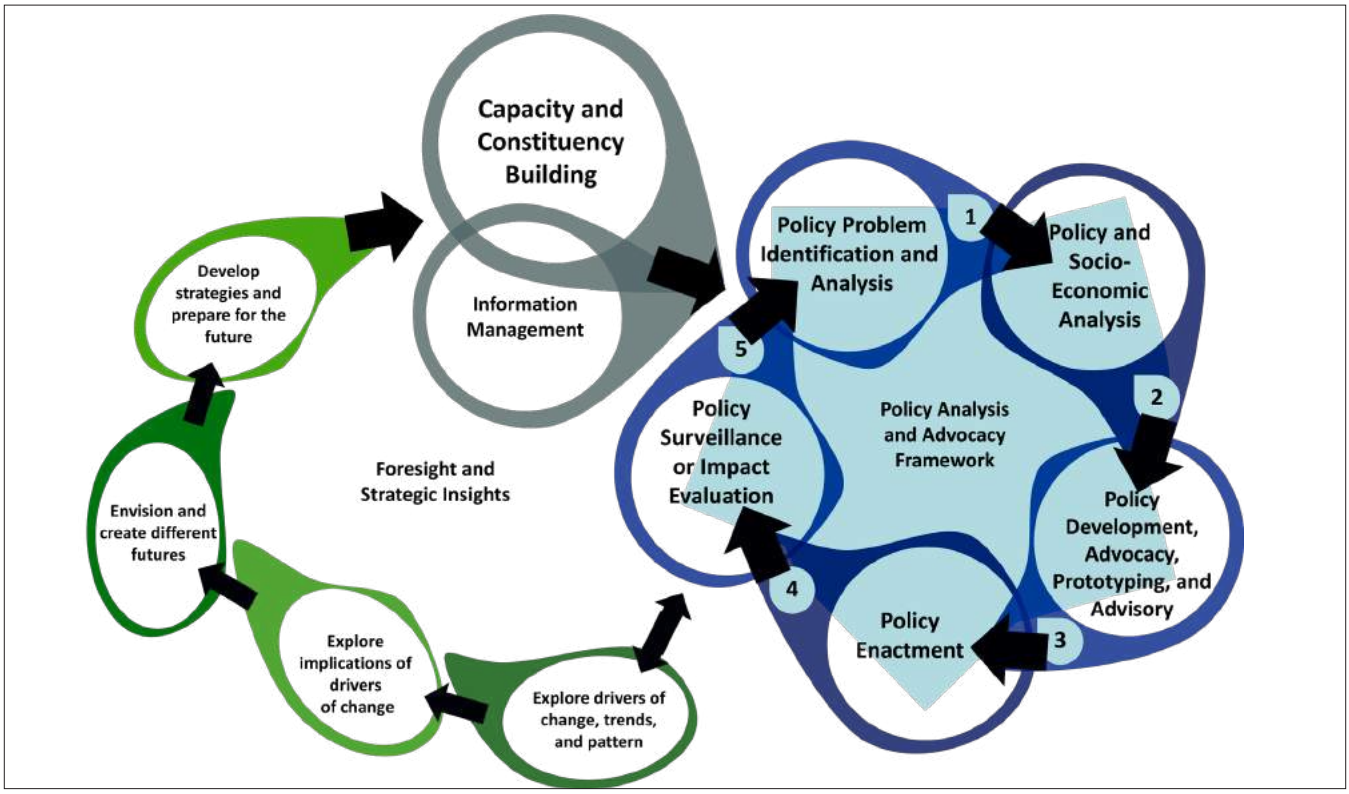
Business Innovation through S&T Industry Program for the Animal Health Industry

DOST's Business Innovation through S&T program grant, the BioAssets Corporation in Sto. Tomas, Batangas has procured and set up equipment for next-generation sequencing, sample storage, and biobanking. Moreover, BioAssets researchers have started trial runs and optimization for the molecular analysis and sequencing of ASF virus. They have also executed a memorandum of agreement with CMU as the first recipient of the Mobile Laboratory Unit (MLU) prototype to be used for the surveillance program. Currently, the BioAssets Corporation is working on the design and fabrication of the MLU while collaborating with DOST-Industrial Technology Development Institute, DA-BAI, Kansas State University, DOST, and DA for the project's research activities.

Enhanced DOST-PCAARRD's Policy Analysis and Advocacy Program

DOST-PCAARRD's Policy Analysis and Advocacy (PAA) Program was further strengthened through the development of the PAA Framework, which unifies and interrelates the Council's policy-related initiatives, including policy analysis, advocacy, foresight and strategic foresight, constituency and capacity building, and information management. This framework is tailored for the country's AANR setting, enabling DOST-PCAARRD to systematically identify policy R&D gaps or concerns, develop PAA initiatives to address such gaps, and establish portfolio-level target outcomes. Most crucially, the framework established a mechanism to guarantee that the Council's efforts are not limited to policy analysis, but also include intensified advocacy initiatives for science-informed reforms and recommendations aimed at achieving specific policy objectives.

The framework provided underpinning and direction for the projects packaged in 2021. Most of the project proposals approved took off from the recommendations of the previous policy analysis studies and/or the policy concerns in the AANR that needed to be examined and were identified through the framework. The PAA R&D agenda also focused on examining policy concerns and developing inputs to policies for sustainable resource management and conservation. Hence, the PAA portfolio has greatly evolved, from mostly policy analysis in 2020 (57% of 2020 portfolio) to including policy advocacy and natural resource economics in 2021 (59% of 2021 portfolio), to ensure that the policy recommendations are effectively advocated.



DOST-PCAARRD Policy Analysis and Advocacy Framework.

Project team of the policy analysis project, "Assessment of Policy Constraints to the Effective and Efficient Conduct of Public R&D in the Philippines," while discussing their findings.

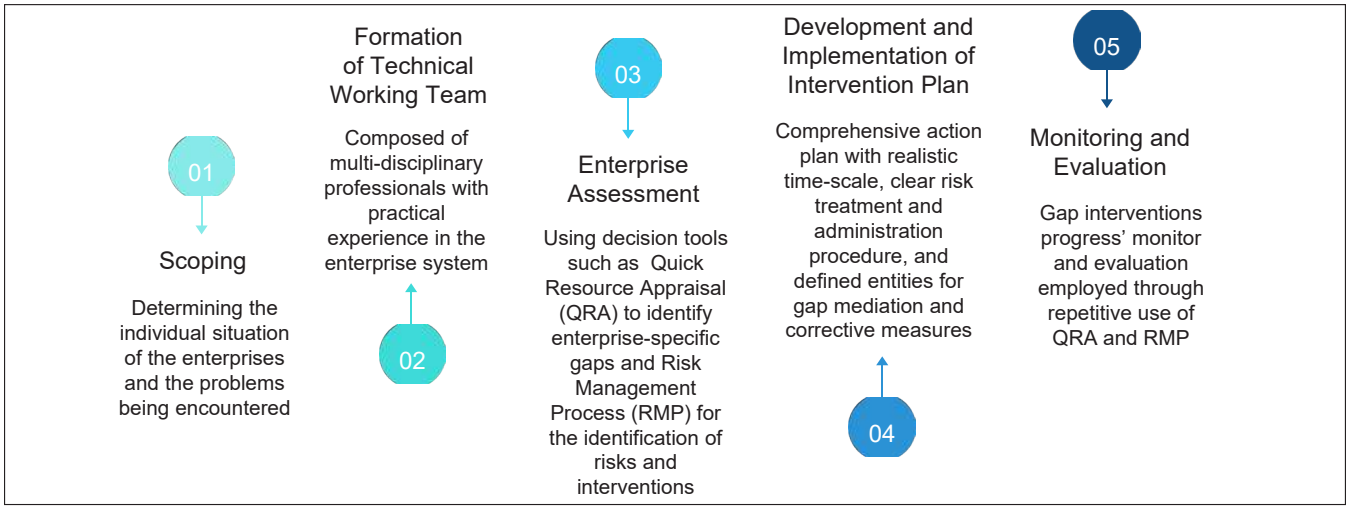
Establishment of the Agri-Aqua Business Unit

The Agri-Aqua Business Unit was established to develop, coordinate, and monitor agriculture and aquatic business-related programs, projects, and initiatives. The primary aim is to connect the R&D system with the enterprise system to ensure that R&D outputs will be utilized to create direct impacts to stakeholders in agribusiness. Eighteen new R&D projects have been developed and are now being implemented by the socioeconomics R&D networks. The unit also manages the operations of the Agri-Aqua Business Hub (AABH) under the DOST-PCAARRD Technology and Innovation Center (DPITC). Through the AABH, operational models were developed to realize the agribusiness potentials of the Council's R&D outputs to generate impacts.

The framework for the development of the market-related services has been developed. An information system was designed for market-related services to create opportunities for MSMEs to reach wholesale markets through virtual linkaging. Two interlinked projects are being piloted for a successful trading environment. By the end of 2021, more than 40 partnerships had been established.

Through the unit, DOST-PCAARRD also continued to trail blaze in the examination of supply/value chain-related issues and amplified efforts towards supply/value chains development to address these various issues.

In particular, the Council established partnerships with the rural-based organizations and local government units (LGUs) to promote the use of internal control systems for safe production of fruits and vegetables and adoption of recommended practices for mango production and post-production. The Los Baños LGU, for example, was tapped to lead the supply chain management system to build a local resilient food system. In this model, farmers bring their products to the LGU which handles the overall management of sourcing and distribution of vegetables. More partnerships are being developed with institutions to address the concerns of small-scale and marginalized farmers' participation in the supply/value chain. The unit leads this initiative towards developing increased collaboration with the key agricultural players to improve communication and develop integrated supply/value chains.



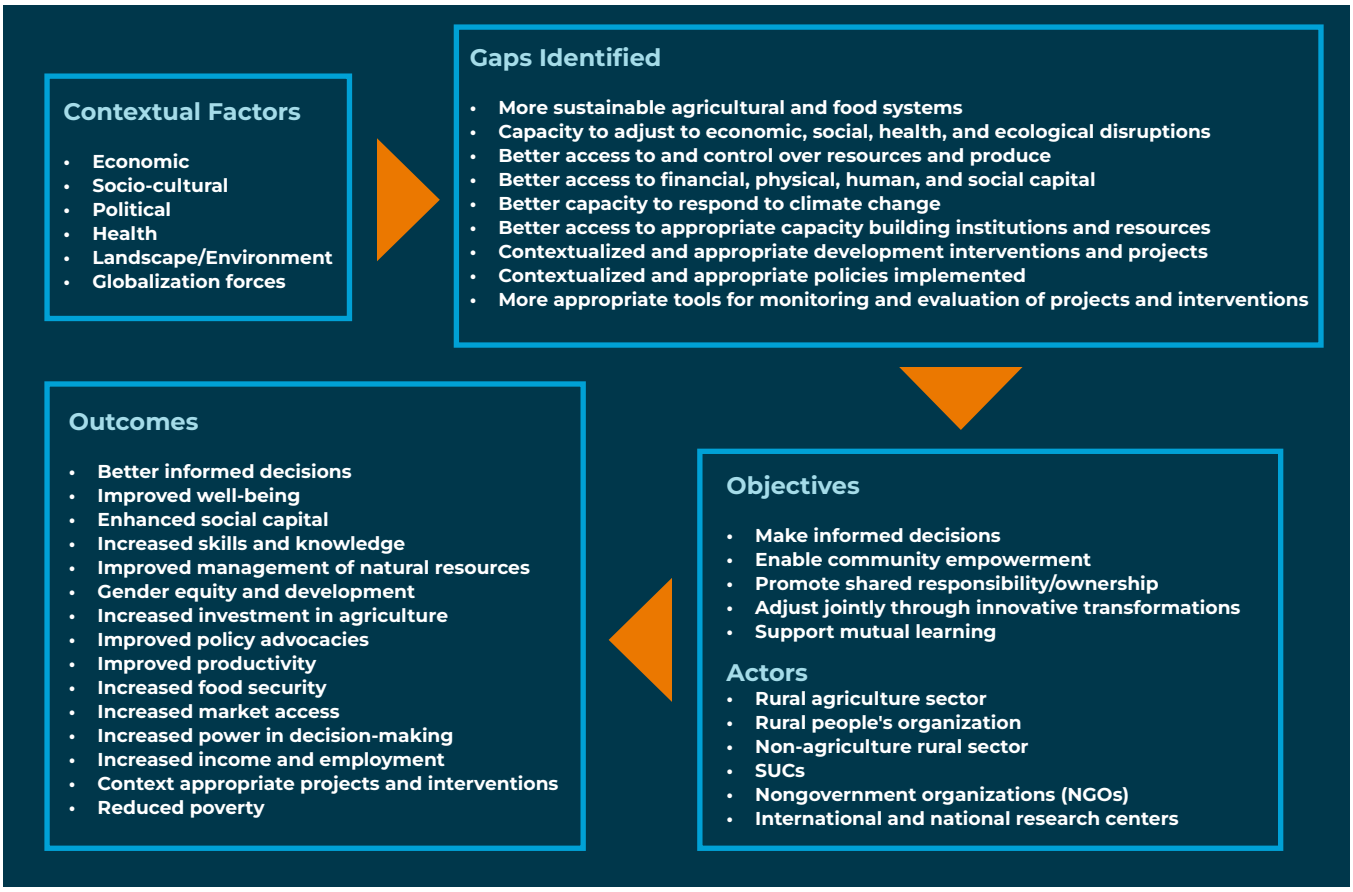
General methodology for enterprise support and development.

Establishment of the PCAARRD Applied Rural Sociology (ARS) Program in AANR

As part of the Council's continuing effort to understand the human face of development in AANR, it has strengthened its initiative on ARS, which started as early as 2000. The ARS program provides an inclusive approach in assessing the sociological and anthropological factors that shape rural economies and agricultural development. Further, it aims to characterize rural space and the rural communities/ societies' relationships and how they continue to shape the structure and functions of these societies.

Initial activities included a series of consultative meetings to firm up the ARS framework, which shall serve as basis for the R&D direction and future sociological researches and initiatives in AANR. Among the key areas that will be covered include rural transformation; landscapes, livelihoods, and society; rural-urban linkages; globalization and the international flow of agricultural products; gender and rural societies; socio-technical systems of agriculture innovations; demographic changes; social practices and rural heritage; rural organization and institutions; contemporary issues; and development Initiatives.

Exploratory meeting with sociology experts: Professor (Prof.) Girlie Abrigo (1st row, center), Dr. Alovera, MSU-IIT (1st row, 3rd from left) and Dr. Rodmyr Datoon, UPLB (2nd row, 1st from left).



R&D Framework for ARS.

Evaluation of PCAARRD CorPlan Implementation

The 2017–2022 DOST-PCAARRD CorPlan was assessed and updates were provided on the implementation status of thrusts/plans under the Council's banner programs. These include at least 3 strategic R&D, 13 plans under R&D results utilization, 12 under policy research and advocacy, 32 plans under capacity building and R&D governance, and 3 thrusts or plans under a special program, GAD. In general, the assessments found that the Council was able to successfully pursue its initiatives across all banner and special programs.

The assessments also identified how the Council responded to the challenges brought by the COVID-19 pandemic through new programs and initiatives that addressed the concerns of the AANR sector, as well as of the R&D network. To further improve the delivery of services, the internal and external factors that affect or may affect CorPlan implementation were identified. Strengths, weaknesses, opportunities, and threats (SWOT) analyses were performed for some initiatives to develop strategies and recommend adjustments in implementation. The findings and recommendations based on the evaluation would be used as a reference in crafting the Council's plan for the succeeding period.

Agenda 3: Engage in R&D to Generate and Apply New Knowledge and Technologies Across Sectors

Coastal Acidification: How it Affects the Marine Environment and Resources in the Philippines

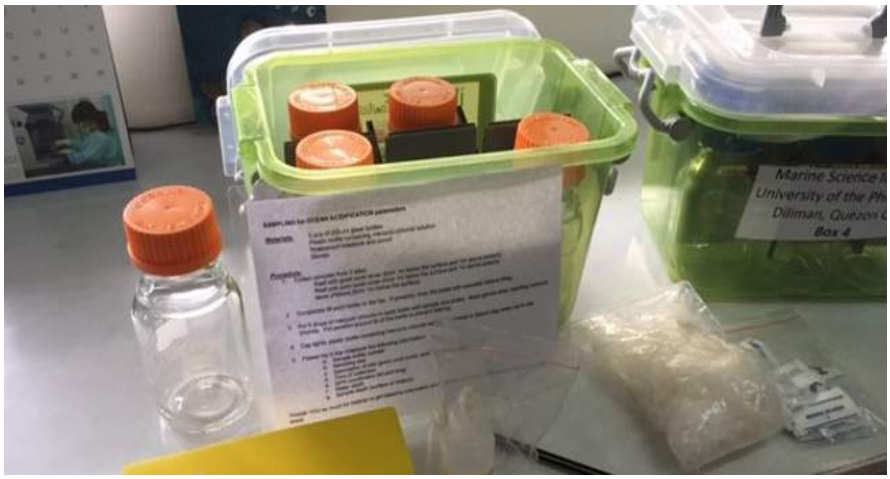
Spatio-temporal Trends in Potential of Hydrogen (pH), Partial Pressure of Carbon Dioxide (pCO2), and Related Parameters

The Philippines lacks carbonate chemistry baseline data. To address this gap, data from 63 sites across the country was generated and presented as seawater pH and aragonite saturation state (ΩArag) maps by the UP-MSI. These maps will be used as basis to compare future changes in ocean acidity. From these baseline information, pH vulnerable areas in the country were identified to determine where acidification should be monitored. This is to guide the development of policies on resources management for mariculture activities and identify areas for restocking and coral restoration efforts, among others. Project results will contribute in justifying the inclusion of coastal acidification to the country's National Climate Action Plan 2011–2028. The Philippines, for the first time, has an actual data on coastal acidification as input to the Global Ocean Acidification Observing Network.

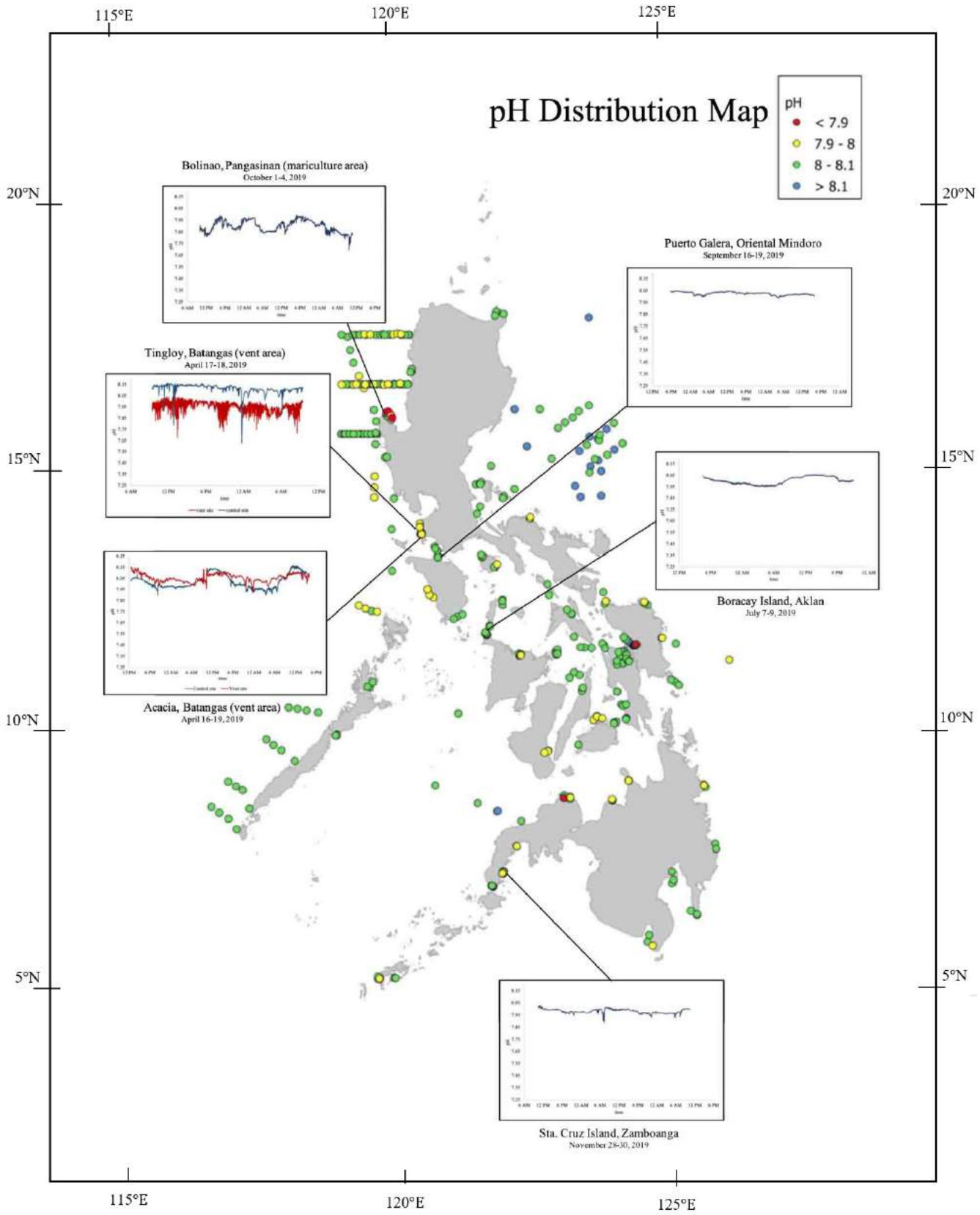
Niskin sampler.

Automated sampler.

Diver-assisted underwater sampling.



Ocean acidification kits.



The pH map of the Philippines produced with data from 63 sites. This map provides baseline information from which future changes in pH is compared and helps identify areas vulnerable to acidification. Insets are time series of pH in six coastal areas.

Information on the Shifts in the Ocean Chemistry on the Marine Food Web Base

The country also lacks information on what shifts in the ocean chemistry mean for the marine food web base. Micro- and mesocosm-scale experiments were conducted to understand what happens to the planktons when the pH shifts. Microcosm experiments with the use of a mass flow instrument investigated shifts in bacterial and plankton communities in different water types at the Bolinao Marine Laboratory in Pangasinan. Mesocosm experiments captured organisms from bacteria to larger plankton natural communities in the eutrophication-affected fish farming area of Bolinao to understand interactive effects of ocean acidification and eutrophication. The mesocosm is the first of its kind to be designed, constructed and used in a field study in the Philippines. These studies of the UP-MSI are important in bridging the dearth of baseline information on the potential effects of ocean acidification within the context of tropical ecosystems.

Microcosm experiment setup using mass flow instrument.

First mesocosm experiment designed and constructed in the country.

Responses of Reef Organisms to Changing pH and Temperature

The UP-MSI-implemented project demonstrated the complex effects of ocean warming and acidification on various reef organisms, particularly near mariculture areas. Acidification impeded coral recruitment, caused bleaching and death of giant clams and sponges, and reduced the grazing activities of sea cucumbers and sea urchins. However, ocean warming and acidification also had positive impacts on other organisms with sponges and fleshy macroalgae showing continued growth, while marine biofilm periphyton were not affected. Elucidation of the specific responses of these organisms gives us a better understanding of the varied ecological impacts of perturbed seawater chemistry on coral reefs. This knowledge provides relevant input towards strategies for climate change adaptation measures for biodiversity conservation, food security, and livelihood of the poorest and most vulnerable sectors of the Philippines—fisher families and coastal communities that rely on reef resources' continued availability.

Monitoring the effects of elevated temperature and acidic waters on various marine animals and plants.

Recruitment slides deployment to monitor the effects of acidic waters on biofilm communities.

Collection of samples for genetic analysis to assess the impact of ocean acidification.

Testing the response of giant clams to acidification and warming in a natural setting at the Mainit CO_2 bubbles reef site.

Multi-scale Studies to Determine Extent of Corals and Coral Reef Vulnerability to Changes in Water Chemistry

The DLSU-implemented project highlighted the variability of the coral assemblages' responses to ocean acidification and the necessity to find appropriate scales at which these factors are predictable and detectable. Studies of corals and coral reefs need to be done at scales where they are relevant. For example, surveys examining a single coral assemblage at one point may be unable to detect the stressors' effect like increasing temperatures, where its consequences may come gradually and over a wider area. Conversely, examining coral data only on a broad scale (e.g., the entire Philippines) may lead to overlooking more localized reef damage caused by small-scale disturbance or stressors. Studies in Mabini, Batangas where volcanic vents create acidic conditions showed that some corals could tolerate acidified ocean conditions, albeit for only brief periods of time. These conditions are also much localized.

Coral community at a vent site in Mabini, Batangas with bubbles streaming out of the reef.

pH logger deployment at a study site in Mabini, Batangas.

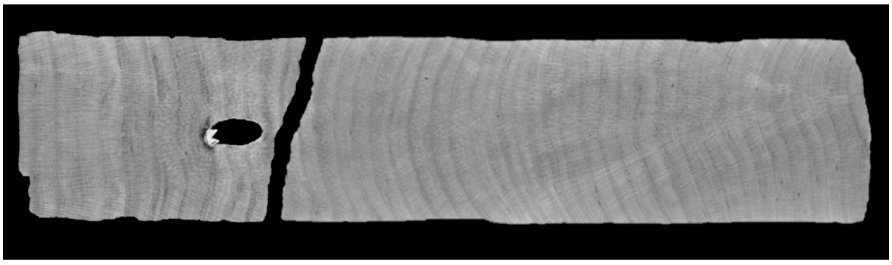
Screening for Radionuclide Contamination from the Fukushima Accident by Iodine-129 Measurement in Corals from the Philippines

Importance of Reconstructing and Detecting Nuclear Activities

The project implemented by the DOST-Philippine Nuclear Research Institute reconstructed and analyzed coral cores from Cagayan, Aurora, and Camarines Norte. Based on the data generated, the magnitude of radiation that will reach the Philippines can now be estimated based on the strength of the nuclear weapons detonated. Further, crucial baseline information that local and national agencies can use to formulate risk reduction and mitigation policies in the event of future nuclear incidents can be acquired. The data are also relevant inputs towards developing policies and management approaches in the country and the region. This project, therefore, highlights the importance of conducting similar studies to increase awareness on how other countries' activities around the region affect their neighboring countries.

Sampling of coral cores from *Porites* spp. from Palaui Island, Sta. Ana, Cagayan.

Iodine (in pink) extracted through various solvents.



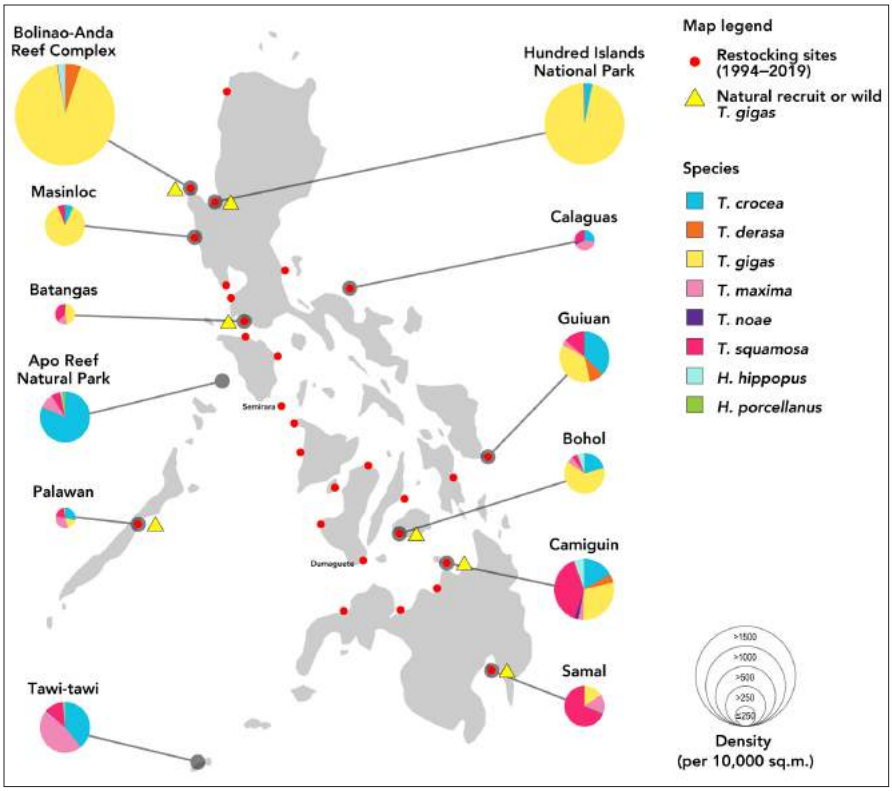
3D-xray computed tomography image of a coral core from Baler, Aurora, revealing its annual density bands.

Analysis by AMS and ICP-MS in the University of Tokyo, Japan.

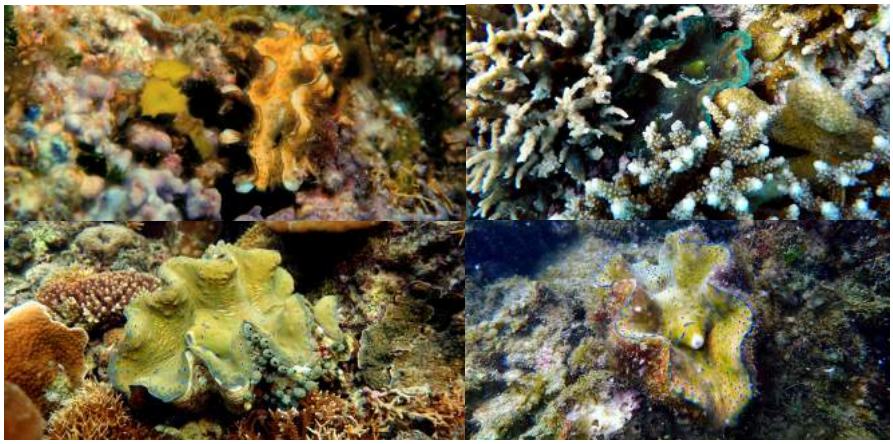
Assessing the Status of Giant Clams and Advancing Culture Techniques

Status of Local Stocks, Restocked Giant Clams, and Recruits' Presence

Recent surveys revealed that giant clams' abundance and diversity remain low despite being prevalent in the Philippine reefs. Natural recruits of *Tridacna gigas* were observed at some long-term restocking sites providing evidence that restocked individuals are already naturally spawning, especially in well managed reefs. Diversity of giant clams' symbionts (Family Symbiodiniaceae) was also examined to evaluate how these populations fare under prevailing environmental conditions. Results showed an association among divergent giant clam species from different sites with diverse profiles of Symbiodiniaceae. Site-specific and host-specific structuring of Symbiodiniaceae communities were detected, which may indicate a potential mechanism for environmental adaptation. Information dissemination activities such as seminars and workshops helped raise awareness among coastal communities, concerned stakeholders, and the general public about giant clam biology and conservation. Insights from these findings provide important ecological bases and help reinvigorate efforts for effective giant clam conservation and management enhancing socioeconomic benefits.



Giant clam recruits' restocking sites.



Giant Clam recruits found in Calaguas restocking site.

Rare Giant Clam species *Tridacna noae* found in Calaguas restocking site.

Utilization of Marine Fisheries Species in the Production of Protein Hydrolysates

Protein hydrolysates are chemically or enzymatically hydrolyzed proteins consisting of varying peptides sizes with functional and biological activities. These simpler peptides are easily absorbed and can be utilized to assist and facilitate body function and metabolism. UPV and its industry partner Pascual Pharma Corp. is implementing a DOST-CRADLE project that advances marine fisheries species utilization in protein hydrolysates production and addresses current issues to produce better food products for better survival and good health maintenance of immunocompromised individuals and the general populace. The project refined the process protocols and low value and underutilized raw materials utilization from marine sources, including mollusks (i.e., oyster, mussel, and squid), fish species (i.e., bigeye scad, sardines, bullet tuna, lowfin pomfret, and snake mackerel), and seaweeds. The project has produced 10 chemical and 10 food grade hydrolysates. The food grade hydrolysates will comprise a core protein blend, which is currently being developed and will later be used for a blended hydrolysate product.

Macroalgae Fermented-feed Additive for Chicken Using Microbial System

Utilizing the untapped source of seaweeds' diverse population with fermentation application to develop a sustainable diet for chicken is one of the R&D initiatives that could boost the country's poultry production. The University of San Carlos and Fujen Catholic University in Taipei, through the Manila Economic and Cultural Office-Taipei Economic and Cultural Office (MECO-TECO) Joint Research Project, used *Padina* sp., *Ulva* sp. and *Halymenia* sp. as sources of protein and energy. The seaweed fermentative processes utilized functional microorganisms and cellulose-degrading bacteria in solid and submerged state fermentation. The developed fermented feed additive contains unique polysaccharides and is rich in proteins, lipids, and some special compounds. Including fermented seaweed in diets will have no anti-nutritive effects on broiler chickens, but will improve their feed intake, live weight gains, and feed efficiency; and breast meat composition with lower cholesterol and fat content.

Powdered hydrolysates.

Preparation of seaweeds for the fermentation procedures using two fermentation methods: submerged fermentation and solid-state fermentation.

Agenda 4: Strengthen and Utilize Regional R&D Capabilities

DOST-PCAARRD in the Regions

DOST-PCAARRD continued to support the implementation of the "Regional Collaborative Program for AANR R&D in the Regions." The 15 regional consortia and its member-institutions, which consist of 288 R&D implementing (SUCs/ higher education institutions [HEIs], research and development institutes [RDIs]), and private and non-R&D implementing agencies (LGUs, NGOs, other government organizations, etc.) responded to the needs of stakeholders in the regions through the Council's banner programs on strategic R&D, R&D results utilization, capability building and governance, and policy analysis and advocacy.

The Council provided the consortia with a P36.2-M budget for their management and operations in the regions. This financial support was 19% higher than the previous year. The assistance enabled the consortia to deliver S&T-based initiatives and perform regional planning and programming, monitoring and evaluation (M&E), and coordination of R&D and technology transfer activities in the regions. The Council also participated and provided technical assistance during their Regional Research and Development Coordinating Council (RRDCC) meetings, workshops, agency in-house reviews, and Regional Symposium on R&D Highlights as part of its M&E activities in the regions.

DOST-PCAARRD approved 204 R&D projects for implementation by various consortia member institutions (CMIs) and five consortia-led proposals were packaged and approved for funding and implementation.

Through the regional collaborative program, there were 635 trainings/ webinars conducted by 233 CMIs and participated in by 21,283 researchers/attendees from different CMIs and other agencies. The consortia was also provided with an additional funding for the upgrading of their information and communications technology (ICT) infrastructure due to a greater demand for an ICT facility.

Joint RRDCC chairpersons, consortium directors, and PCAARRD Directorate's meeting held on February 2, 2021 via Zoom.

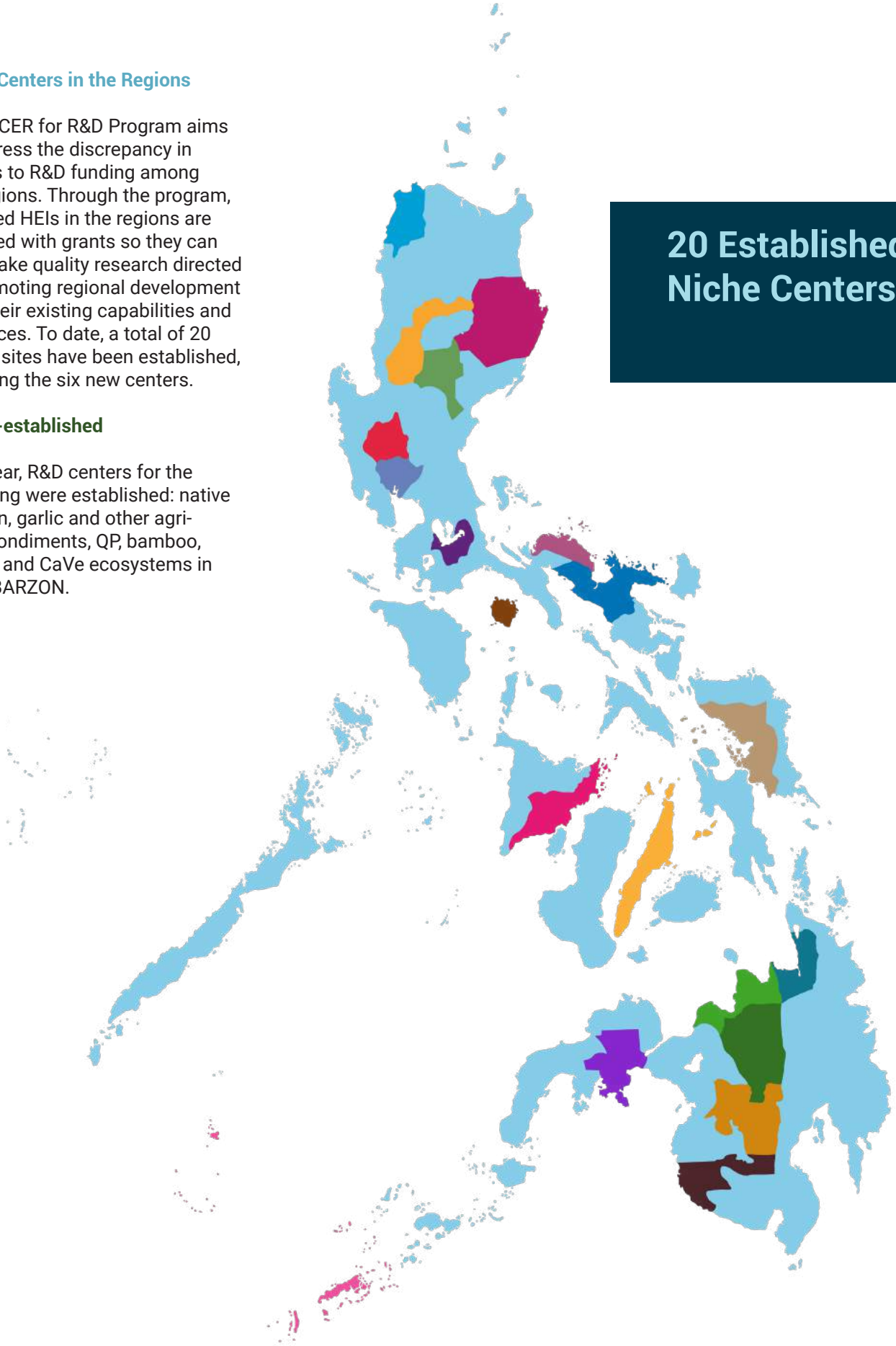
Niche Centers in the Regions

The NICER for R&D Program aims to address the discrepancy in access to R&D funding among the regions. Through the program, qualified HEIs in the regions are provided with grants so they can undertake quality research directed at promoting regional development with their existing capabilities and resources. To date, a total of 20 NICER sites have been established, including the six new centers.

Newly-established

This year, R&D centers for the following were established: native chicken, garlic and other agri-food condiments, QP, bamboo, cacao, and CaVe ecosystems in CALABARZON.

20 Established Niche Centers



Mariano Marcos State University (MMSU) for Garlic

Benguet State University (BSU) for Potato

Isabela State University (ISU) for Citrus

Nueva Vizcaya State University (NVSU) for Freshwater Fisheries Catch

Tarlac Agricultural University (TAU) for Sweetpotato

Pampanga State Agricultural University (PSAU) for Tamarind

University of the Philippines Los Baños (UPLB) for CaVe Ecosystems

Marinduque State College (MSC) for Native Pig

Camarines Norte State College (CNSC) for Queen Pineapple

Bicol University (BU), Central Bicol State University of Agriculture (CBSUA), Partido State University (ParSU) for Pili

Samar State University (SSU) for Crustaceans

University of the Philippines Visayas (UPV) for Mollusk

Cebu Technological University (CTU) for Biodiversity

Western Mindanao State University (WMSU) for Native Chicken

Caraga State University (CarSU) for Industrial Tree Plantation Species

Mindanao State University (MSU)-Naawan for Sea Cucumber

Central Mindanao University (CMU) for Bamboo

University of Southern Mindanao (USM) for Cacao

Sultan Kudarat State University (SKSU) for Halal Goat

Mindanao State University (MSU)-Tawi-Tawi for Seaweed

Center for CaVe Ecosystems Research

UPLB virtually launched the Center for CaVe Ecosystems Research last June 14 in partnership with the Department of Environment and Natural Resources (DENR), LGUs, SUCs, and NGOs. This is the first comprehensive research program that dealt with extensive biodiversity assessment of caves in CALABARZON. Research and documentation of the faunal, floral, terrestrial arthropods, and microbial diversity of the five selected caves provided benchmark information on the diversity and ecology of caves in the Philippines.

The terrestrial vertebrates team and field guides retrieve cave bats and birds from the mist nets setup at the Cavinti Cave's entrance.

The hydrogeological survey team performs water flow rate survey at the Cavinti Cave's entrance and outflow sites.

Cacao R&D Center

The Cacao R&D Center was officially launched in USM in Kabacan, Cotabato last August 27. Around 1,200 cacao variety seedlings of UF18 and BR25 were distributed to 25 willing cacao nursery operators in Regions XI and XII. The seedlings were molecularly verified and certified by the Bureau of Plant Industry-National Seed Quality Control Services (BPI-NSQCS). These will serve as genetic stocks or mother plants in the nursery, which can boost the Philippine's cacao industry by ensuring and promoting the propagation, utilization, and production of cacao high yielding varieties.

Dr. Edward Barlaan (8th from left) and the cacao nursery operators with the signed agreement.

Native Chicken R&D Center

The Native Chicken R&D Center has established the forage production area in preparation for the feed formulation that will be developed for the ZamPen chickens. This is composed of a nursery for Trichantera with 3,000 cuttings planted. Planting of additional 2,000 cuttings is ongoing. Of the targeted 25 ponds of Azolla, 10 ponds have initially been established along with 20 ponds for duckweed.

Dr. Edward Barlaan (leftmost) distributing the molecularly verified cacao planting materials to the cacao nursery operators.

Bamboo R&D Center

Initial data gathering, inventories on bamboo, and virtual pressers were conducted. The Council also participated in the NICER Summit, which was conducted virtually last December 3 and was attended by DOST, HEIs, and other intergovernmental institutions.

Queen Pineapple R&D Center

During the program's first year of implementation, 66 barangay agricultural extension workers (30 males and 36 females) in Labo, Basud, and San Vicente in the Bicol Region were trained and oriented on global positioning system (GPS) mapping and soil sampling. The ten identified sites based on the pink pineapple mealybug (PPMB) virus incidence were distributed to two sites each in Basud, San Lorenzo Ruiz, San Vicente, Daet, and Labo in Camarines Norte. About 7,300 images of pests were identified and collected. This includes white grub, ants, termites, mealy bug, and June bug. They have also started the prototyping, software development planning, and wire framing of QP Intelligent Pest Detector and Crop Protection Management System.

Garlic R&D Center

Sixty-three local accessions of garlic and other agri-food condiments (ginger, kinchay, black pepper, achuete, chili pepper, and roselle) were collected. A field genebank has been recently established. Furthermore, the program developed black garlic-flavored ice cream, with ongoing evaluations on consumer acceptability. Moreover, the team is collaborating with the Tuklas-Lunas pharmacy team of Mariano Marcos State University (MMSU) to develop black garlic-based medicinal products.

QP pest identification and dataset collection.

Focus group discussion (FGD) to small QP farmers in Basud, Camarines Norte.

Garlic experimental site at MMSU Campus, City of Batac, Ilocos Norte. (Image credit: Garlic Research Center-MMSU)

Shallot experimental site at MMSU Campus, City of Batac, Ilocos Norte. (Image credit: Garlic Research Center-MMSU)

Ongoing

Seaweed R&D Center

The Seaweed R&D Center has collected more than a thousand wild and farmed eucheumatoids samples from six municipalities in Tawi-Tawi. About 445 individuals of wild *Kappaphycus* spp. and 278 individuals of wild *Eucheuma denticulatum* samples in Tawi-Tawi will be propagated in the laboratory, hatchery, and sea-based nursery. This has been the richest collection of eucheumatoid specimens by far known for any research endeavor. A GIS distribution map of wild *Kappaphycus* spp. and *E. denticulatum* and a GIS map of the 52 Kappaphycus and *E. denticulatum* varieties that were farmed in Tawi-Tawi have been prepared.

A comprehensive morphological, genetic, physiological (survival and growth rate) and chemical (carrageenan yield and quality) characteristics of these collections are being documented and profiled morphologically. Voucher specimens are also kept in the Mindanao State University-Tawi-Tawi College of Technology and Oceanography (MSU-TCTO) Herbarium.

Approximately 2,184 branch cultivars and 2,502 sporelings are currently maintained in the seaweed cultivars lab.Thirty-three varieties of laboratory-generated farmed and wild Kappaphycus seedlings have been propagated at the MSU-TCTO land-based hatchery and sea-based nursery in Lato-Lato, Bongao, Tawi-Tawi.

A survey of moisture content (MC) and impurities of raw, dried seaweeds collected from farmers and traders of Tawi-Tawi showed an average MC of 60–78% and impurities of 6–13%.

Branch cultivars and sporelings currently maintained in the seaweed cultivars laboratory of MSU-TCTO.

Laboratory-generated farmed and wild Kappaphycus seedlings propagated at the MSU-TCTO land-based hatchery.

Laboratory-generated farmed and wild Kappaphycus seedlings propagated at the MSU-TCTO sea-based nursery in Lato-Lato, Bongao, Tawi-Tawi.

Pilot testing of seaweed dryer.

Sea Cucumber R&D Center

The Mindanao State University-Naawan has developed the culture technology for white teatfish (*Holothuria fuscogilva*) and refined the culture technology for sandfish (*H. scabra*), which are geared towards responsible stock enhancement.

A total of 181,200 first-stage juveniles of sandfish (weighing <1g each) were produced from breeders that were reared in ocean nurseries in Misamis Occidental and Camiguin and distributed to 35 beneficiaries for grow-out culture. A total of 21,000 sandfish juveniles were seeded in Camiguin and Misamis Occidental for stock enhancement.

Through the sea cucumber program, the first white teatfish hatchery in the Philippines was established and successfully produced juveniles. The hatchery documented the spawning, hatching, and larval development until the juvenile stage of the white teatfish, to which 9,000 juveniles were produced. Twenty percent of the hatchery-produced white teatfish juveniles were seeded for stock enhancement in Laguindingan, Misamis Oriental, while 460 *H. fuscogilva* juveniles were grown into breeders.

Sweetpotato R&D Center

One of the significant accomplishments of the "Sweetpotato (SP) NICER Program" is the accreditation of SP nurseries of both the Tarlac Agricultural University (TAU) and the Mayantoc SP Clean Planting Materials (CPM) Producers Cooperative by BPI. Improved facilities and procedures for virus indexing upscaled the production of CPM, thereby paving the way to achieve its enhanced availability and distribution regulation throughout the region and nearby provinces.

Suitability and climate risk vulnerability maps for SP production have also been developed for the Central Luzon region including Pangasinan. A spectral radiance of 11 SP varieties was gathered with the acquisition of data images using unmanned aerial vehicle (UAV) and spectrometer.

Component technologies for ICM were identified for lahar-laden and lowland rainfed areas that include colored varieties adaptable to local conditions and preferred by consumers, atmometer-based furrow irrigation and use of organic fertilizers to increase yield, and use of SP sex pheromone to manage SP weevil infestation.

Inspection of SP farm for BPI's certification/tagging of planting materials. (Image credit: TAU)

Awarding of Certificate of Accreditation for TAU's SP Plant Nurseries and the Mayantoc SP-CPM Producers Cooperative (center and right). (Image credit: TAU)

Harvesting and distribution of SP-CPM. (TAU 2021)

Gathering spectral radiance of SP varieties using UAV and spectrometer. (Image credit: TAU)

Processing of data for the generation of suitability and climate risk vulnerability maps. (Image credit: TAU)

SP varieties tested in lahar and lowland rainfed areas are for propagation, maintenance, and promotion. (Image credit: TAU)

Atmometer-based irrigation setup. (Image credit: TAU)

Setting up of experiments for component technologies in ICM. (Image credit: TAU)

Native Pig R&D Center

The Native Pig R&D Center expanded its free-range area by 3,025 square meters (m^2) to accommodate more Markaduke breeders. It also developed 6 ha for forage production and planted these with 11,065 different forages and root crops. In addition, 2,343 seedlings of trichanthera and 1,299 cassava cuttings were produced and distributed to Markaduke native pig farmer-cooperators.

Improvements to the facilities for lechon production and the slaughtering and processing house were facilitated to accommodate eight lechon at a time.

As of September 30, the center's current Markaduke native pig inventory is 591 with 95 sows, 17 replacement gilts, 9 boars, and 470 growing pigs. This is 30% higher than 2020's inventory. To date, more than 65% of sows have produced 10 or more piglets, and the total inventory of Markaduke native pigs in farmer-cooperators' farms is 69 hd composed of 38 sows, 20 replacement gilts, 6 boars and 5 growing-finishing pigs.

Halal Goat Science and Innovation Center

The project on halal feeds development formulated the palm kernel cake rations, which will be validated during the feeding trial in Year 3. Positioning strategies for the previously developed chevon tapa, tocino, and carne norte were also established. A business plan was packaged and presented to possible takers during the networking event on September. Eventually, three entrepreneurs showed interest. Currently, negotiations are ongoing.

To promote halal goat production, three modalities targeted for specific customer segments were developed and rolled out. Fifty training facilitators were capacitated using the Farmer Livestock School on Halal Goat Enterprise Management (FLS-HGEM). Seven episodes of the school-on-the-air (SOA) on halal goat production were aired over Cotabato's two radio stations and live streamed over Facebook (FB) Live for those not reached by FLS-HGEM. For those who prefer to stay home and use the internet, the seven-module eLearning course on halal goat production was completed and uploaded at www.e-extension.gov.ph.

This is expected to generate at least 50 graduates in Year 3. These three strategies will ensure that geographically-dispersed audiences will be able to obtain technologies on halal goat production, enterprise development, marketing, and processing.

The building of the Halal Goat Science and Innovation Center was completed. Sultan Kudarat State University (SKSU) also developed the curriculum for Halal Goat Science as a major field of study under the BS in Agriculture Program, which will be with Commission on Higher Education by the end of Year 2 and offered in next school year. To enable the school to offer this curriculum, SKSU forged a collaborative agreement with Universiti Teknologi Mara of Malaysia to beef up the capability of 21 SKSU manpower on the various halal science disciplines.

Halal Goat Science and Innovation Center at SKSU.

Agenda 5: Maximize Utilization of R&D Results through Technology Transfer and Commercialization

Technology Transfer and Commercialization

Celebrity Endorsers Magnifiy Tech-adoption by the Private Sector

The Council was able to gain support from celebrity influencers in the promotion of technologies on native pig and native chicken production. The celebrity produced promotional vlogs highlighting the S&T that were put into the production of native pigs. Moreover, teaser videos were produced to invite the public to attend the activities of DOST-PCAARRD. This has increased the social media and internet visibility of the Council's R&D activities on the development and improvement of native pig and native chicken. This is expected to encourage farmers to use science-based technologies and practices to improve their respective enterprises.

Mr. Marvin Agustin promotes technologies on native chicken.

Technology Promotion

Harmonizing Information, Education, and Communication and Advocacy Initiatives

Learning from its experiences and accomplishments in the past year, the Council has strengthened and refined its efforts most especially in R&D outputs promotion and advocacy. The Council also initiated new programs and initiatives as it pursued its science communication function by strengthening its IEC programs and harnessing the potentials of knowledge sharing platforms such as the social media in its multimedia campaign strategies and approaches.

ISM Program to Promote the GALING-PCAARRD Projects and DOST-PCAARRD's Biodiversity S&T Program

HIRAyA Program. The HIRAyA in support of the "GALING-PCAARRD Kontra COVID-19 Program" and other initiatives aimed to strengthen the Council's science communication initiatives through development and utilization of ISM programs and activities. HIRAyA launched 14 ISM programs featuring AANR technologies, programs, and events.

SciComm Project. The project, "Effective Science Communication Campaign Series for Enhancing PCAARRD's Visibility focusing on the Natural Resources/Biodiversity Sector (SciComm)," aimed to boost the awareness on DOST-PCAARRD's initiatives on science communication campaigns and producing more content to promote its R&D programs and initiatives in the AANR sector, particularly the natural resources/biodiversity sector. Through the project, the following topics/contents were produced and launched through the Saribuhay YouTube series.

Initial gains from the initiatives of the HIRAyA and SciComm projects have greatly impacted the Council's information and advocacy drive especially in emerging platforms such as social media. The multimedia content produced, like GALING-PCAARRD videos that are shown in Saribuhay episodes on YouTube, became instrumental in increasing the Council's presence in its online platforms. In YouTube, the number of subscribers increased by 76.47% from 1,160 in October to 2,047 after launching the Saribuhay campaign, 7.67% of which can be directly attributed to the series.

DOST-PCAARRD Saribuhay episode.

The multimedia contents/episodes produced and uploaded on YouTube during the same period garnered the top three spots for the Council's most number of total views in 2021. Among the three episodes uploaded to date, the latest release Saribuhay Episode 3 Part 1 had the highest view count of 10,573, making it the most viewed content in the Council's YouTube account in 2021. Overall, the total combined views of the three episodes as of December is 16,698.

The increase in views of the YouTube episodes mentioned is also a result of the social media advertising initiative implemented under HIRAyA Project 2. FB and YouTube ads were carried out, supporting the virtual events conducted on FB and increasing the views of the Saribuhay episodes on YouTube. The 3-month advertising budget of P30,000 supported three episodes of Saribuhay on YouTube, 13 virtual events on FB, and more than 25 FB posts promoting the virtual events.

Promotional initiatives on FB, complemented with FB ads, reached 1.36 M people and gained 5,464 new followers for three months. As a whole, promotional initiatives carried out on FB for the past year resulted in a 3.5-M reach and 22,247 new followers.

Participation to National S&T Promotion Events and Exhibits

The Council also produced audiovisual (AV) materials in participation with two major national events—the 2021 National Science & Technology Week (NSTW) and the 6th National R&D Conference (NRDC).

Production of AV Presentation for the 6th NRDC. DOST-PCAARRD joined the 6th NRDC on November 10 and 17. The virtual event with the theme, "Pananaliksik at Pagpapaunlad: Daan Tungo sa Pagbangon (Road to Recovery through R&D)," showcased programs and technologies in support of the government's whole-of-nation approach to recovery from the pandemic. The Council's AV contributions include the following:

- Pananaliksik at Kaunlaran Para sa Matatag na Kabuhayan,
- Polisiya at Siyensya: Gabay sa Matatag na Food Security System,
- Agham at Teknolohiya Para sa Pangangasiwa ng Saribuhay at Kaunlaran ng Susunod na Salinlahi,
- Securing Safe and Sufficient Food Supply thru S&T, and
- Updates on the Harmonized National R&D Agenda

Improvement of the Virtual Platform for the DPITC Exhibition. The Council also updated its virtual exhibit in terms of its design/theme and content during its participation in the 2021 NSTW celebration with the theme, "Agham at Teknolohiya: Tugon sa Hamon ng Panahon." It featured eight new innovations, in addition to those featured in last year's virtual exhibit.

Engaging the Regional R&D Consortia through AANR Vlog

The regional R&D consortia took their AANR products, technologies, and services to social media through PCAARRD's call for AANR vlog making contest during the 2021 NSTW. The contest aimed at encouraging creativity among students, government employees, and economic frontline workers in promoting the AANR sector's role in addressing the COVID-19 pandemic's challenges. Through this contest, the regional R&D consortia were encouraged to promote local AANR technologies, programs, and/or services to the general public through YouTube vlogs. Through this activity, 15 vlogs were produced and submitted, which were made available during the NSTW celebration. The activity allowed the R&D consortia to promote their products, services, and R&D centers during the weeklong NSTW celebration. Likewise, it also contributed in improving the visibility of the DOST-PCAARRD's YouTube channel, adding more than 20,000 combined organic views and a total of 3,200 likes during the period.

Increasing Social Media Presence

The Council's information dissemination initiatives on social media including the conduct of webinars and virtual press conferences have significantly increased the FB page following. For the whole year, there were 18,887 new followers on FB, engaged 62,737 people on its videos and livestreams and 652,686 people in its posts, and a reach of 3,403,798 people.

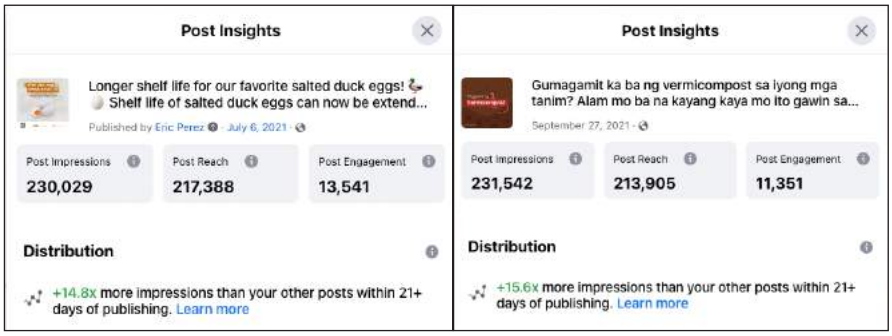
For 2021, there were 92 new followers on Twitter, 142 on Instagram, and 1,286 on YouTube. The Council also conducted 31 virtual events, organized by the different divisions and promoted through the different social media platforms. Of these, the major events organized by the Council were six virtual press conferences or pressers.

Valuing PCAARRD's Public and Media Relations

DOST-PCAARRD produced a total of 170 articles. Its media relations activities such as its coordination and conduct of radio/television (TV) interviews and pitching of stories to print publications, yielded a total of P115,549,922.24 media value or the amount that DOST-PCAARRD would have spent in advertising if the Council did not practice public and media relations.

There were 589 articles published on print and online publications about DOST-PCAARRD. In terms of radio interviews, the Council had a total of 66 radio and 13 TV interviews.

DOST-PCAARRD vlog as part of the NSTW 2021 celebration.



DOST-PCAARRD facebook posts with a reach of 217,388 and 213,905, respectively.

DOST-PCAARRD pitched articles with media value of P1,165,500 and P673,992, respectively.

Facilitating Technology Commercialization through FIESTA

The Council developed a virtual event format that was relayed to the consortia through a training workshop. It also served as a venue to kickstart the planning for the mango, native chicken, vegetables, and native pig cluster FIESTAs.

On December, three consortia, namely: Southern Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium (SMAARRDEC), SOCCSKSARGEN Agriculture, Aquatic and Natural Resources Research and Development Consortium (SOXAARRDEC), and Visayas Consortium for Agriculture, Aquatic and Natural Resources Program (VICARP) conducted the first virtual Cluster FIESTA on Mango via Zoom and the FIESTA FB page. The event reached a total of 24,612 people on FB through its various activities, which included a press conference; webinar on enhancement of mango production; launch of a vlog with social media influencer Ruben Gonzaga; digital poster making contest and infomercial contest; and technology business forum.

Through the Council's media relations initiative, the virtual Cluster FIESTA on Mango was featured in Manila Bulletin, Eagle Broadcasting Corporation, BusinessWorld, The Daily Guardian, Agriculture Monthly, and various online news aggregator sites.

The technology business forum led to the agreement between the University of Southeastern Philippines (USeP) and Rampec-Raymund Pecajas for the commercialization of the mango sprayer and picker of Engr. Filmann Simpao, agreement between Engr. Oliver Masesar and USeP for the hot water treatment technology of Engr. Filmann Simpao, and the show of interest of Panabo City farmers regarding the mango sprayer and fruit picker.

Promoting Technologies and Innovation through Printed IEC Materials

The Council produced 56 technical publications, leaflets, flyers, information bulletins, and 15 collateral materials to promote projects and programs in the AANR sectors. A total of 66,475 IEC materials were disseminated to 38,584 clients mostly from the regular mailing list.

To broaden the Council's audience reach in its printed technical publications, another publication line has been added to the roster of technical publications. The PCAARRD Policy Brief has been registered to the National Library of the Philippines and will be released quarterly.

Broadening and Increasing Access to R&D Information through the DOST-PCAARRD eLibrary

The Council also takes pride in the DOST-PCAARRD eLibrary that serves as an online knowledge dissemination platform amid COVID-19 pandemic. The features of the eLibrary were enhanced towards a more advanced user experience, as well as promoting its services to cater to the information needs of more AANR clients.

As of December, the DOST-PCAARRD eLibrary recorded a total of 11,239 registered members and 21,761 publication downloads, posting 81% to 122% increase from the previous year, respectively. Most downloaded materials include topics on organic and urban agriculture, vegetable gardening, broiler and beef cattle production, and tilapia farming, among others. The Philippines Recommends remained as the highly sought publication line among readers.

In bringing AANR information closer to the people, the PCAARRD eLibrary remains steadfast in expanding its collections. Of the 8,260 total collections tallied in 2021, 2,016 were the newly added titles that were made available for reader access and download.

The eLibrary also gained external recognition as the Council's Science Library Integrated Management System (SLIMS) and was benchmarked by different government offices such as National Fisheries Research and Development Institute and Philippine Institute for Development Studies. Further, website linkages to several SUC eLibraries including UPLB were also established.

A SLIMS mobile application that will be more portable and convenient for users is currently being developed and is scheduled for launch by the end of the project in 2022.

56

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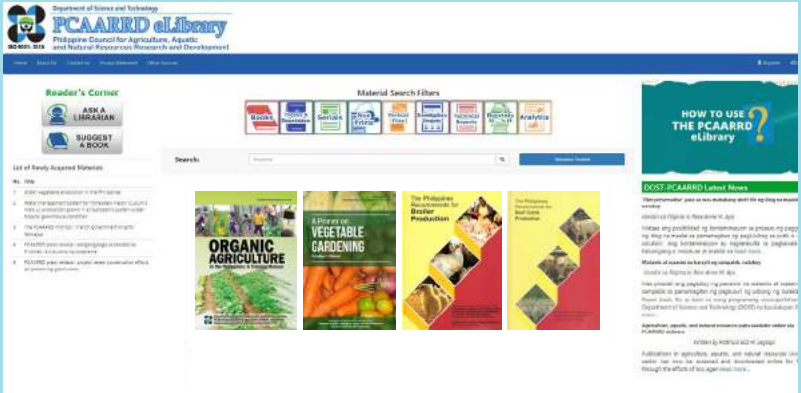


Intellectual Property Management

Seventeen participating SUCs and RDIs were able to file 220 IP applications. Fifty-nine technology transfer officers were trained on patent mining who in turn generated patent mining reports for 17 priority commodities. Meanwhile, 30 additional SUCs outside the IP-TBM network were assisted in crafting/revising their institutional IP policies.

DOST-PCAARRD established and strengthened 25 new IPTBM offices with the assistance of five mentor-agencies in the Ilocos, Southern Tagalog, Bicol, Western Visayas, and Southern Mindanao Regions. The program was able to file 763 IP applications (106 patents, 243 utility models, 36 industrial designs, 68 trademarks, and 310 copyrights); capacitated 128 SUC staff through the virtual 10-module IP masterclass and technology commercialization mentorship series; and held the 3rd DOST-PCAARRD technology pitching event, which featured 35 mature technologies.

To date, the whole IPTBM program has generated income from commercialization agreements estimated at P395,000. The technologies transferred to private partners through licensing in 2021 are shown in Table 4, while more technologies have ongoing negotiations with potential commercialization partners.

A total of 247 IP applications for patents, utility models, industrial designs, and trademarks were processed under the project, while the IP Office of the Philippines conducted five Formality Training sessions to capacitate the staff of DOST agencies on preliminary assessments and formality examinations of IP application documents.

Business Development/Technology Business Incubation

The 16 ATBIs have supported and mentored a total of 302 businesses/incubatees using 92 technologies generated by the host institutions. These incubatees generated 1,603 new jobs while reaping P68.7-M revenues. The ATBIs themselves generated P11.7 M in revenue. This year, the Council approved the establishment of six more ATBI facilities in Pampanga, Bataan, Cebu, Ifugao, Albay, and Davao City, thereby increasing the presence of ATBIs in 13 regions across the country. In view of RA 11337 or the Innovative Startup Act and the DOST Startup Grant Fund Program, the Council provided support to seven startup/spinoff companies that commercialize DOST-supported technologies.

Thirteen ordinary farms were transformed into Science for the Convergence of Agriculture and Tourism (SciCAT) farm tourism enterprises that showcase technological convergence to improve productivity and capacity for sustainable farming practices. To date, 21 packages of technologies generated through DOST-PCAARRD support are being showcased and promoted by these farms, which generated 49 adopters that include two farmer associations. During this pandemic, the farm owners and staff were capacitated on online marketing of their produce to counter the decline in gate receipts due to pandemic restrictions.

Table 4. Technologies that have been transferred to adoptors under licensing agreements.

No.	Technology	Agency	Adopter/Licensee
PCAARRD-funded			
1	Banana floral apex tissue culture	USM	Prof. Harem R. Roca (BFLEX Company)
2	Mango power nozzle sprayer	USeP	RAMPEC Enterprises
3	Mango Integrated Postharvest Facility	USeP	Division 16
4	Modified mango fruit picker	USeP	RAMPEC Enterprises
Not PCAARRD-funded			
5	Cocowine with wild honey	SSU	Dr. Edelyn Echapare
6	Kamangeg cheesecake	MMSU	Ms. Margie Eclarin Taguiporo Paoay Lake Resort
7	Multipurpose seeder	PhilRice	ACT Machineries
8	Ride-on Buoyant Tiller	PhilRice	ACT Machineries, New Era Industries, Green Valley Machineries, and Global Marketing and Construction Corp.

Technology Promotion through Various Platforms and Events

To enhance the promotion of the ATBI program, the "Technology Innovation and Agripreneurship Event Series" was conducted on June 23–24. The two-day event was divided into three parts: the ATBI initiatives virtual launch that featured the ATBI Celebrity Ambassador actor Piolo Pascual, SEC-registered Agri-Aqua Business Incubation Network of the Philippines Inc., ATBI real-time monitoring system, ATBI Media Conference, and virtual webinar titled "Tech it to the Next Level: Innovation and Agripreneurship under the ATBI Program."

The two-day activity, which generated 7,400 views with 466 peak live viewers, 16,600 reach, and 1,711 FB engagements, is part of the project titled, "Communication Planning and Media Campaign for the DOST-PCAARRD ATBI Program" that aimed to strengthen the program's digital and media presence, increase awareness, and showcase and promote all ATBI initiatives and activities.

DOST-PCAARRD and the DA-Bureau of Agricultural Research jointly hosted the 1st DOST-DA technology transfer forum for the agri-aqua sector on September 30, 2021 via Webex and FB Live. With the theme, "TechFlix: Kabuhayan, Kita, at Kaunlaran," the event gave an opportunity for innovators of 8 farm machinery and 11 food-related technologies to pitch their mature technologies to potential investors. The forum, graced by DOST Secretary Fortunato T. de la Peña and DA Secretary William D. Dar, accentuated the efforts of both agencies to intensify and support the transfer and commercialization of technologies generated from government-funded R&D initiatives.

Table 5. List of startup/spin-off companies that received support from DOST-PCAARRD in 2021.

Name of Company	Business Owner
Algacon Aquafeeds Manufacturing	Ms. Soledad S. Garibay
Blitzkrieg Animal Diagnostic Center	Dr. Clarissa Yvonne J. Domingo
BDOZ Veterinary Products Trading	Dr. Bede P. Ozaraga
ElbiTech Inc.	Mr. Rodel P. Anunciado
Fullmight Agricultural Corporation	Dr. Virginia M. Padilla
Vera Bella Enterprises Limited Co.	Dr. Dana G. Vera Cruz
Agricom Best Foods Corporation	Mr. Samuel B. Cariño

Project Leader Dr. Pablo Rafael, Jr. awarded the certificate of recognition to Mr. Piolo Pascual as the ATBI Celebrity Ambassador.

The first DOST-PCAARRD and DA-BAR technology transfer forum on agri-aqua via Webex and FB Live.

Agenda 6: Develop STI Human Resources and Build a Strong STI Culture

DOST-PCAARRD's "Human Resource Development Program (HRDP)" remained strong and committed in providing services and opportunities that will enhance the capabilities of its partners.

Graduate Research and Education Assistance Program

From CY 2017 to CY 2021, 79 grantees (comprised of 58 MS and 21 PhD) have already been awarded with GREAT assistantship. For CY 2021, DOST-PCAARRD managed and monitored 37 scholars (23 PhD and 14 MS), including 13 MS and 4 PhD for CY 2021 intake.

Twelve scholars, 7 MS, and 5 PhD, completed their degrees during the year. In addition, five re-entry proposals from four GREAT alumni were approved.

Several GREAT alumni participated in research summits and conventions and where some were awarded with Best Papers. Others were also promoted in their respective workplaces.

The Council recently approved the inclusion of graduate students of PhD by Research into the GREAT Program. Aside from the usual benefits of a GREAT scholar, a PhD by Research grantee under the GREAT Program may also avail of additional privileges such as the additional dissertation grant, foreign travel grant, and publication fee. These additional privileges aim to further assist the scholar to smoothly implement this study.

Thesis/Dissertation Assistance Program

The DOST-PCAARRD "Thesis/ Dissertation Assistance Program" provides financial support for graduate students' thesis/ dissertation expense of P50,000 and P100,000 for MS and PhD, respectively, for research that fall within DOST-PCAARRD's priority areas. This year, the Council granted assistance to eight graduate students (4 PhD and 4 MS).

Publication Incentives Program

PIP is complemented by the training course on technical writing for publication in a refereed journal sponsored by PCAARRD for researchers and scholars in the NAARRDN. The program encourages and motivates NAARRDN researchers and scholars to publish their research results in reputable, local refereed and international journals. The incentive ranges from P25,000 to P80,000 depending on the journal's impact factor where the article was published.

The number of awards increased to 108 journal articles from 73 in the previous year. This translates to a total publication incentive of P7.160 M benefiting various institutions in 13 regions. Notably, 100% of these submissions were published in journals indexed in SCOPUS/Web of Science (formerly ISI), denoting the high quality of journal articles by these researchers. Futhermore, 26% of the grantees are outputs of DOST-PCAARRD and DOST-funded projects and thesis/dissertation.

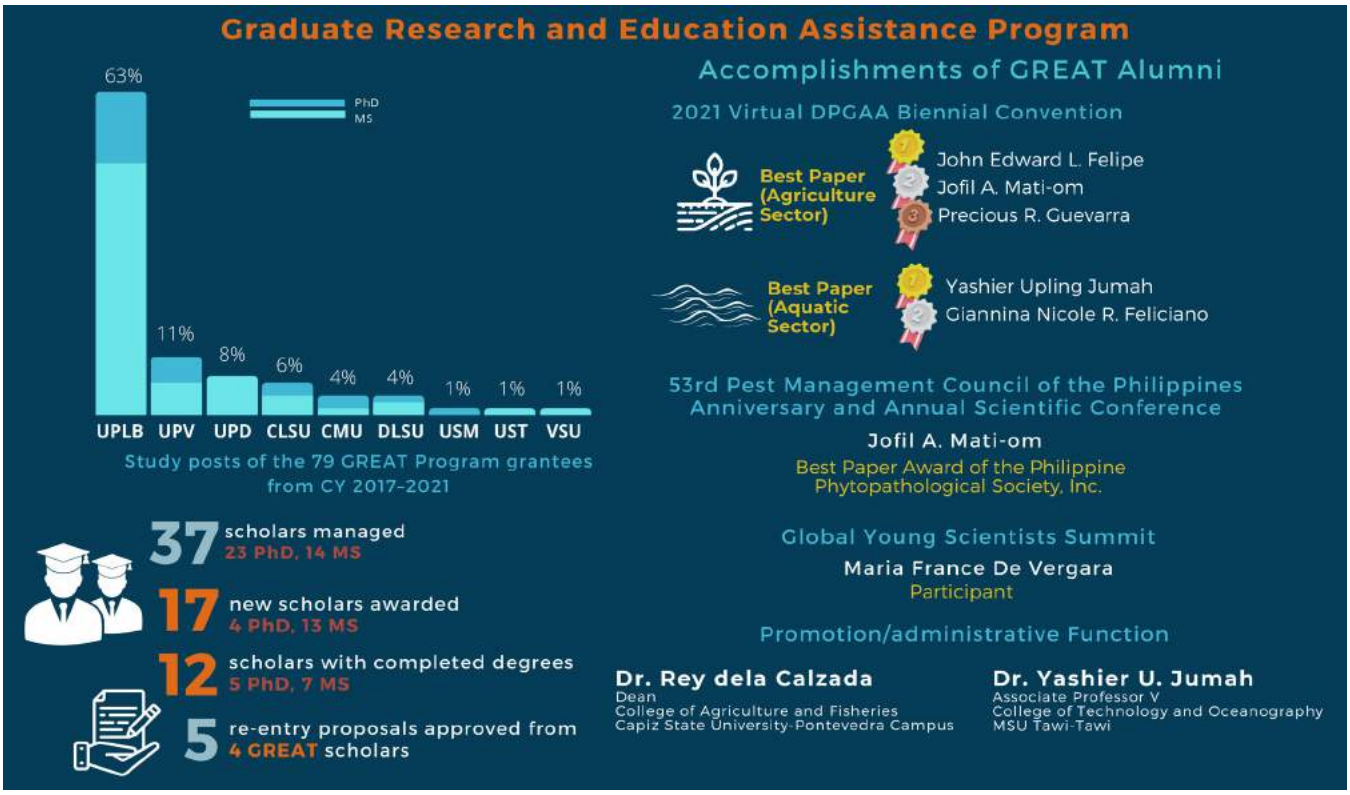
Non-degree Training Program

The PCAARRD Advanced Learning Management System (PALMS), the Council's online training platform, continues to gain popularity while enabling the conduct of online non-degree training courses offered by the Council to its partners and stakeholders. To date, the system has 2,360 users with 403 views of the synchronous training materials.

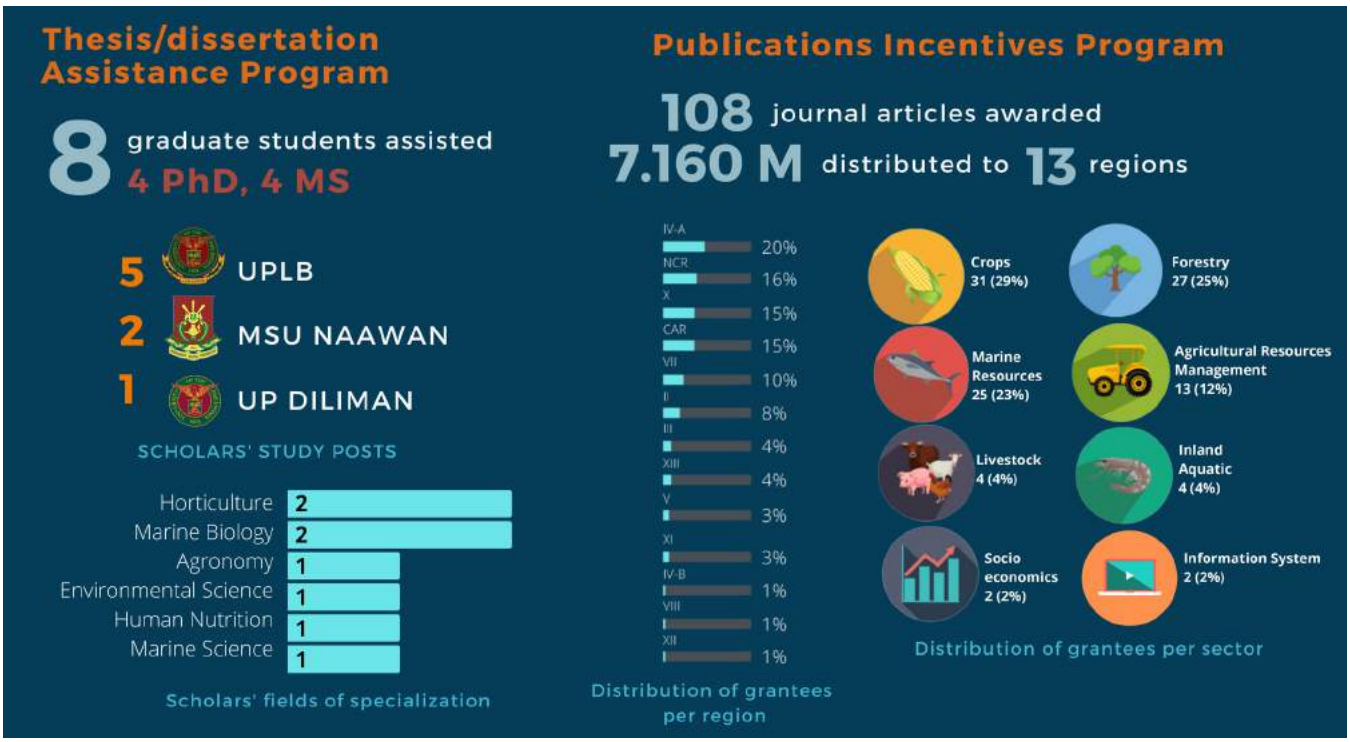
New training modules for the different courses were compiled, reviewed, standardized, and uploaded, while existing modules were updated in the PALMS. As of December, the PALMS has hosted 44 training courses and webinars, with 150 modules and 7 videos uploaded. These are only accessible to the training course participants.

In addition, the PALMS contains technology-based learning materials that are products of DOST-PCAARRD-funded projects. DOST-PCAARRD and the regional consortia contributed in the uploaded 7 brochures, 136 slide decks, and 69 videos. These learning materials are open to everyone and can be accessed anytime.

Thirty-seven online training courses were conducted in 2021, equivalent to 984 training hours, benefiting 1,196 researchers, scientists, engineers, licensed agriculturists, DOST-PCAARRD-GREAT and DOST-HRDP scholars, select NAARRDN member agencies' staff, DOST-PCAARRD technical staff, entrepreneurs, and private sector employees. Training courses varied from technology, R&D management, and socioeconomics related topics.



Accomplishments of DOST-PCAARRD GREAT Program, CY 2021.



Accomplishments of DOST-PCAARRD Thesis/Dissertation Assistance and Publications Incentives Programs, CY 2021.

With the renewal of the Council's Accreditation from PRC as CPD Provider for Agriculture, four training courses were accredited with an aggregate of 85 CPD units, benefiting 35 licensed agriculturists. Twelve non-degree training (NDT) courses have ready materials with instructional designs that are ready for submission to PRC for CPD accreditation.

To complement the online NDT courses currently being offered in PALMS, technology-based materials that have been consolidated will be further developed into asynchronous courses. This initiative ensures that information and technologies generated from R&D programs and activities will continue to be disseminated and will be made more accessible to a wider range of end-users.

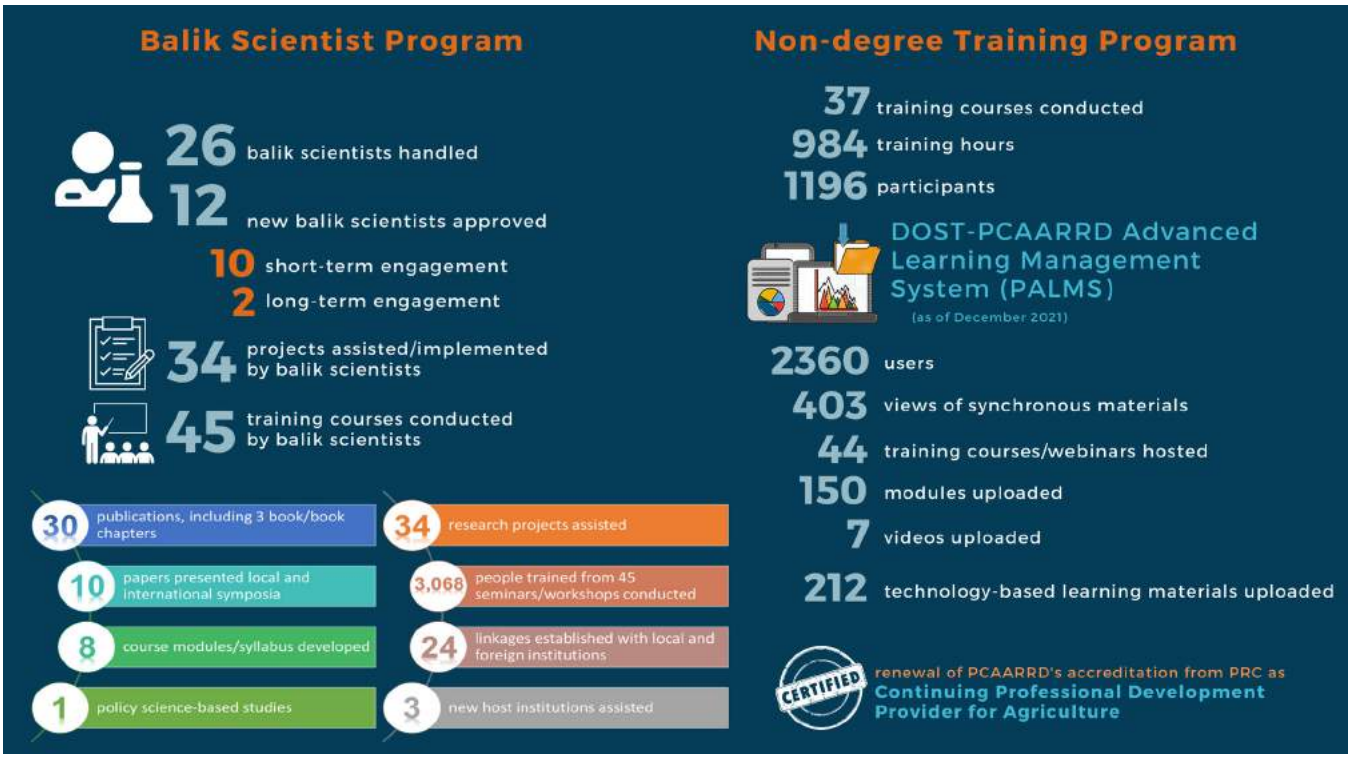
Balik Scientist Program

The "Balik Scientist Program" (BSP) continues to uphold its mandate to utilize the expertise on STI of Filipino scientists abroad despite the COVID-19 pandemic. To make this possible, DOST amended the program's supplemental guidelines to allow online engagements for non-COVID related activities. This is to ensure the safety of Balik Scientists while providing services to their chosen host institutions in the Philippines.

The 12 newly-approved Balik Scientists came from USA, Canada, Australia, Japan, Taiwan, Thailand and Botswana. They were hosted by eight academic institutions and three government offices located in Regions II, IV-A, VI, VIII, X, CAR, and NCR).

Both the new and continuing Balik Scientists were involved in activities from different ISPs in crops, livestock, marine and inland aquatic resources, natural resources, and climate change. The Balik Scientists assisted and implemented 34 research projects. Long-term Balik Scientists were involved as project leaders/staff, while short-term Balik Scientists acted as consultants. The results of research projects generated 30 publications (published and submitted), 3 books/book chapters, and 10 papers presented in local and international symposia.

Another major accomplishment is the engagement of Balik Scientists in training researchers, faculty members, and students. Forty-five training courses were conducted benefiting 3,068 people.



Accomplishments of DOST-PCAARRD Balik Scientist and Non-degree Training Programs, CY 2021.

Beneficiaries included those in the host institutions and those invited by their host from other academic and research institutions. Videos uploaded and streamed online for these training sessions generated over 18,000 views.

Long Term Balik Scientists who handled undergraduate and graduate courses developed eight course modules/syllabus to replace or update existing ones. Part of Balik Scientists' goal is to establish linkages between local and international research institutions to forge research collaborations. This year, our Balik Scientists initiated linkages in 24 local and international research institutions.

DOST-PCAARRD Graduate Alumni Association, Inc.

As the Secretariat for the DOST-PCAARRD Graduate Alumni Association, Inc. (DPGAA), DOST-PCAARRD co-hosted the virtual 2021 DPGAA Biennial Convention with TAU on November 3–4. The Convention was attended by 291 members, agency representatives, speakers, and organizing committee members. It featured plenary talks from private and government agencies, and oral paper presentations from its members. The Association was able to recruit 51 new members for CY 2020–2021.

PCAARRD S&T Awards Program

PCAARRD conferred its S&T Awards in recognition of the outstanding contribution of its partners (individuals and institutions) in the advancement of S&T in the AANR sectors, namely: Best R&D Paper Award (Table 6), Dr. Elvira O. Tan Award (Table 7), and Ulat SIPAG Award (Table 8). The winners received a cash prize and a plaque/trophy.

Table 6. Best R&D Paper Awards.

Best R&D Paper Awardees		
Category/Rank	Recipient	Authors/Agency
Research Category		
1st place	"Saving the Imperiled Marilog Forests in Southern Mindanao, Philippines: Inventory, Assessment and Conservation for Sustainable Community Utilization"	Victor B. Amoroso et al. CMU (Northern Mindanao Consortium for Agriculture, Aquatic and Natural Resources Research and Development [NOMCAARRD])
2nd place	"Development of ROSANNA Banana Disease Surveillance System"	Val A. Quimno, Cecirly G. Puig, Gilbert A. Importante USeP (SMAARRDEC)
3rd place	"Zinc Biofortification and Growth Enhancement of Rice and Corn Using Zinc Solubilizing Bacteria"	Robert Nepomuceno et al. National Institute of Molecular Biology and Biotechnology (BIOTECH)
Development Category		
1st place	"Giving Farmers Uwen Fananafedew: Improving Agricultural Extension Policy in Conflict-vulnerable Areas through the LIFE Model"	Emma Ruth V. Bayogan et al. University of the Philippines Mindanao (SMAARRDEC)
2nd place	"Sustainable Homegrown Forages and Complete Nutrient Diet towards Enhancing Growth and Milk Production of Dairy Buffaloes in Nueva Ecija and San Agustin, Isabela"	Daniel L. Aquino et al. PCC-Nueva Ecija (Central Luzon Agriculture, Aquatic and Natural Resources Research and Development Consortium [CLAARRDEC])
3rd place	"Disaster Risk Reduction of Climate Change Impacts on Vegetable Terrace Farms in Benguet"	Alexander W. Fagyan et al. BSU (CorCAARRD)

Best R&D Paper Awards 2021 presenting authors/awardees for the research category: (L-R) Dr. Victor B. Amoroso (1st Place), Dr. Gilbert A. Importante (2nd Place), and Mr. Robert Nepomuceno (3rd Place).

Best R&D Paper Awards 2021 presenting authors/awardees for the development category: (L-R) Dr. Emma Ruth V. Bayogan (1st Place), Dr. Daniel L. Aquino (2nd Place), and Dr. Alexander W. Fagyan (3rd Place).

Table 7. Dr. Elvira O. Tan Awards.

Best R&D Paper Awardees		
Category/Rank/Recipient	Authors/Agency	Presenters
EO Tan - Agriculture Category		
"Growth Response of Cacao (*Theobroma cacao* L.) Plant as Affected by Bamboo Biochar and Arbuscular Mycorrhizal Fungi in Sterilized and Unsterilized Soil"	Nelly S. Aggangan, Angelbert D. Cortes[a], and Consorcia E. Reaño	 **Mr. Angelbert D. Cortes** Lead/Main Author (CvSU)
EO Tan - Aquatic Sciences Category		
"Predicting Fish Kills and Toxins Blooms in an Intensive Mariculture Site in the Philippines Using a Machine Learning Model"	Aletta Concepcion T. Yñiguez[b] and Zheina J. Ottong	 **Dr. Aletta Concepcion T. Yñiguez** Lead Author (UP-MSI)
EO Tan - Natural Resources and Environment		
"Soil C Quantities of Mangrove Forests, their Competing Land Uses, and their Spatial Distribution in the Coast of Honda Bay, Philippines"	Jose Alan A. Castillo[c], Armando A. Apan, Tek Narayan Maraseni, and Severino G. Salmo III	 **Dr. Jose Alan A. Castillo** Lead Author (DENR-ERDB)

[a]Nominee from Cavite State University (CvSU)
[b]Nominee from University of the Philippines-Marine Science Institute (UP-MSI)
[c]Nominee from DENR-Ecosystems Research and Development Bureau (ERDB)

Table 8. Ulat SIPAG Awards.

Ulat Sipag Awardees 2021			
Awards		Awardee	Agency
Ulat SIPAG Award - National Broadcast Category	First place	 **Ms. Hermelina C. Tenorio**	**Syensya na Tekno Pa** Radyo Agila Eagle Broadcasting Corporation
	Second place	 **Dr. Josephine D. Agapito**	**Pinoy Scientist** Radyo Agila Eagle Broadcasting Corporation
	Third place	 **Ms. Annabelle D. Surara**	**Eat Connect Na** Radyo Agila Eagle Broadcasting Corporation
Ulat SIPAG Award - Regional Broadcast Category	First place	 **Mr. Daniel Castro**	**Diskarte ni Daniel Castro** DZJV 1458 Radyo CALABARZON
	Second place	 **Ms. Rose Anne L. Sibag**	**Kaibigan sa Barangay** DZJV 1458 Radyo CALABARZON

Table 8. (Continued)

Ulat SIPAG Award - National Print Category	First place	 **Mr. Julio P. Yap, Jr.**	Daily Tribune
	Second place	 **Ms. Angelina B. Resurreccion**	BusinessMirror
	Third place	 **Mr. Glendel D. Nazario**	Manila Bulletin
Ulat SIPAG Award - Regional Print Category	Special citation	 **Mr. Julio P. Yap, Jr.**	Panay News

External Awards Received

2021 Civil Service Commission Pagasa (CSC) Award

CSC conferred the Pagasa Award (Group Category) to the DOST-PCAARRD Technology Commercialization (TechComm) Team for leading the programs and initiatives on IP management and commercialization under the DPITC. These are the IP-TBM Program, SciCAT Program, and ATBI Program. Beneficiaries of these initiatives include 60 agencies, researchers of various SUCs and RDIs, entrepreneurs, farmers, and fisherfolks. The team is composed of Director Noel A. Catibog, Ms. Lucy A. Lastimosa, and Ms. Mae A. Dagaas of the Technology Transfer and Promotion Division (TTPD), and DOST-PCAARRD Executive Director Dr. Reynaldo V. Ebora.

2021 Freedom of Information Awards

The Presidential Communications Operations Office (PCOO) conferred the Freedom of Information (FOI) Rising Star Award to DOST-PCAARRD during the 2021 FOI Awards held last November 25 in Cebu City. The award was given to the Council for exemplifying great progress and performance in the implementation of the FOI Program.

(L-R) TechComm members Ms. Mae A. Dagaas, Ms. Lucy A. Lastimosa, Director Noel A. Catibog, Dr. Reynaldo V. Ebora, and Ms. Abigail F. Gueco.

Dr. Juanito T. Batalon (Center), Mr. Ramon A. Oliveros (left), and Ms. Shayne M. Barias (right) represented DOST-PCAARRD during the 2021 FOI Summit.

Agenda 7: Upgrade STI Facilities and Capacities to Advance R&D Activities and Expand S&T Services

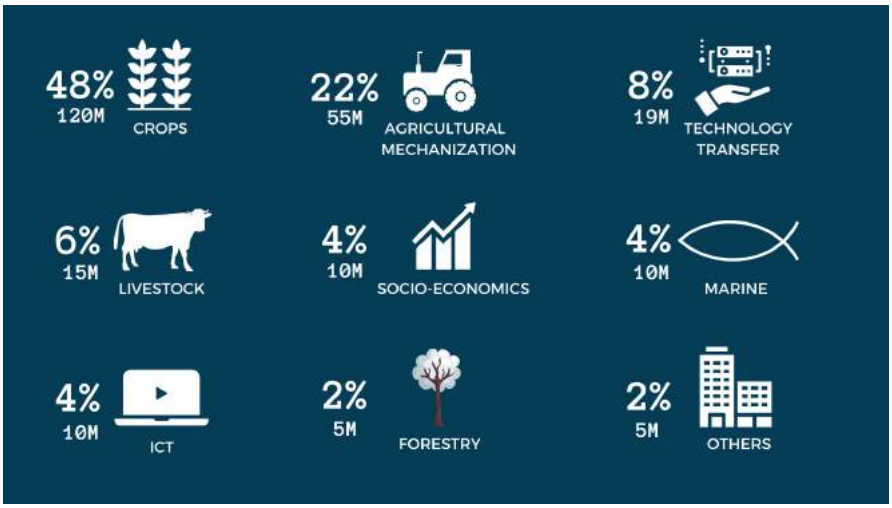
DOST-PCAARRD approved 29 projects with a corresponding investment of P251 M, benefiting 17 partner institutions. All sectors were provided grants, with almost half of the investment going to crops R&D facilities support, while about one-fourth going to agricultural mechanization.

The major projects are for the upgrading of UPLB's Philippine Genome Center (PGC) Agriculture and Agricultural Machinery Testing and Evaluation Center (AMTEC) facilities, Regional Consortia ICT infrastructure, Central Luzon State University (CLSU) ATBI facilities, and Central Bicol State University of Agriculture (CBSUA) vegetable and taro research facilities.

The improvement of PGC Agriculture facilities will provide the Center with additional equipment for use in genomics and other omics-focused research and provide training on the proper use and maintenance of the equipment.

The Council's support to AMTEC will improve their current capacity in agricultural machinery testing, support their role in the implementation of the government's procurement of agricultural machinery as provided in RA 10601, and facilitate the testing of DOST-supported agricultural and fisheries machinery, and other machinery.

The support to CLSU-Agriculture and Food Technology-based Incubator Incubation Facilities aims to strengthen the business performance of start-up incubatees in Central Luzon. Through machines and equipment upgrades, production and processing facilities for the entrepreneur-clients will be enhanced and will provide a favorable operating environment to promote local innovations.



Distribution of facilities improvement per sector for the year 2021.

The Council provided CBSUA facilities upgrade in support of taro and indigenous vegetable research to equip CBSUA with the needed facilities and equipment for its activities. This is in support of the program on boosting the indigenous crops industry in the Bicol Region.

With restrictions brought about by the COVID-19 pandemic, the Council provided support to continue M&E activities in Central Luzon. The ICT infrastructure projects embraces innovative and adaptive approaches in communications technology. For the year 2021, two projects with CLAARRDEC and Cagayan Valley Agricultural and Aquatic Resources Research and Development (CVAARRD) were approved.

Twelve of the facilities development projects were completed despite the limitations brought by the pandemic in the implementation of R&D projects. These improvements enabled DOST-PCAARRD's partner institutions to create an environment for innovative R&D activities.

The IP-TBM Facility of PSAU was inaugurated on December 21. This project aids in further institutionalizing the IP-TBM office and establishing a data hub for IP outputs.

Improved CLSU Biotechnology Laboratory.

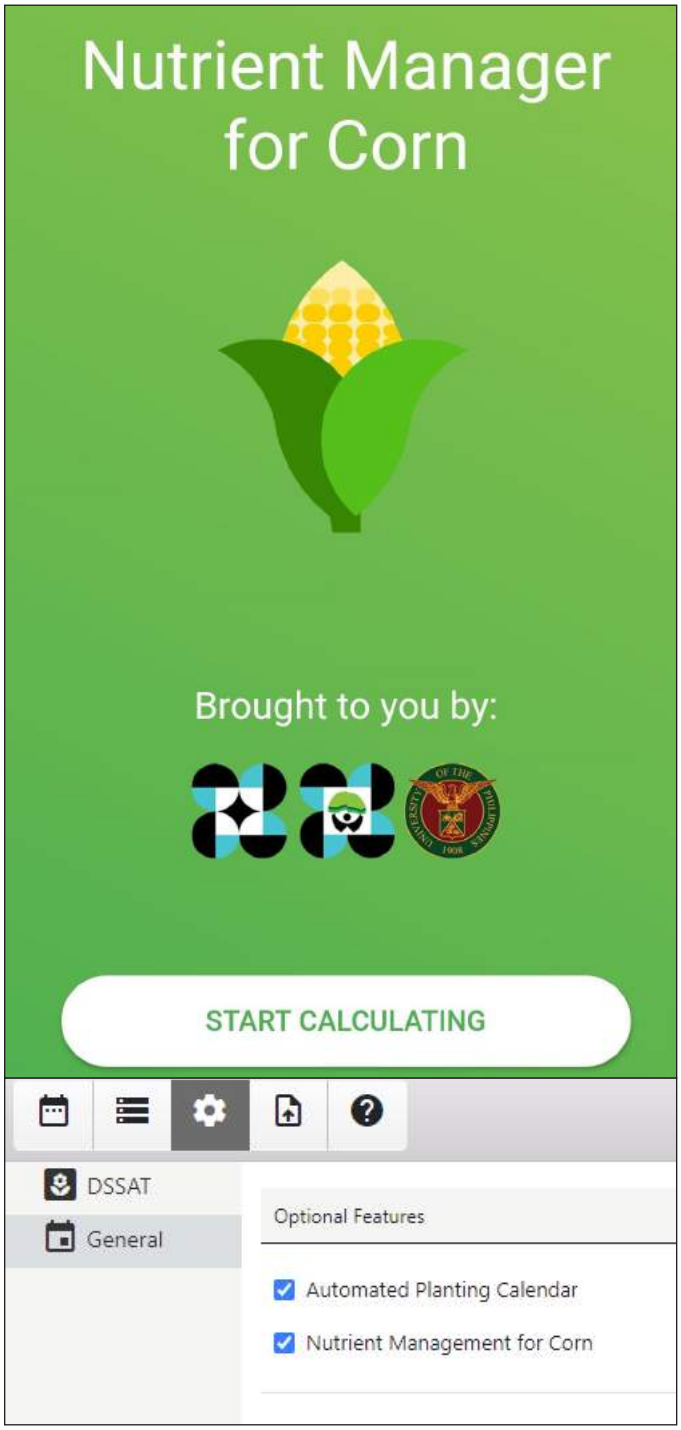
Equipment procured for the Biodiversity Studies advancement in MSU-General Santos City.

Inauguration of PSAU IP-TBM Facility.

Agenda 9: Provide STI-based Solutions for Disaster Risks and Climate Change Adaptation and Mitigation

Crop Characterization, Integrated Crop Management, and Model Development of Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (SARAI) Phase 2

The UPLB-developed nutrient manager for corn is a prototype integrated software being tested to generate fertilizer recommendations with corresponding field and suggested planting dates in selected corn-growing areas. The developed software is based on validated yield data under farmer's field condition and calibrated nutrient management rates during SARAI Phase 1, NPK yield responses in selected corn-growing areas in the Philippines, and corn fertilizer rate for selected sites' target and economic yields. It is expected to generate proper timing of fertilizer application to minimize nutrient loss, thus improve nutrient efficiency. This software will be available as an offline application on computers on a Windows operating system and can be used with or without internet access. Once connected to the internet, the software can also automatically update existing installations. Currently, the program is in its interface improvement for a more user-friendly version and can be downloaded for free at www.sarai.ph. Training on the use of this software can be requested at the abovementioned site.

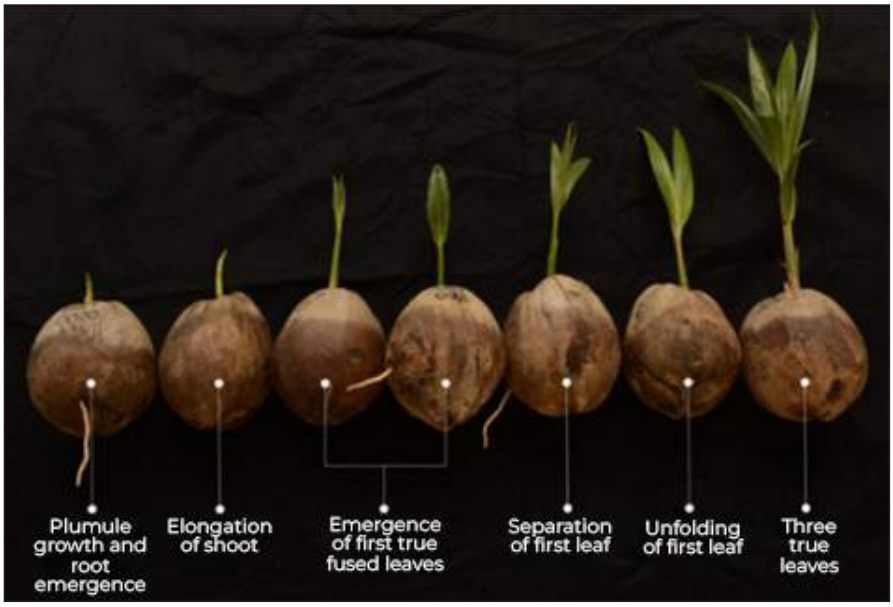


Nutrient manager for corn software.

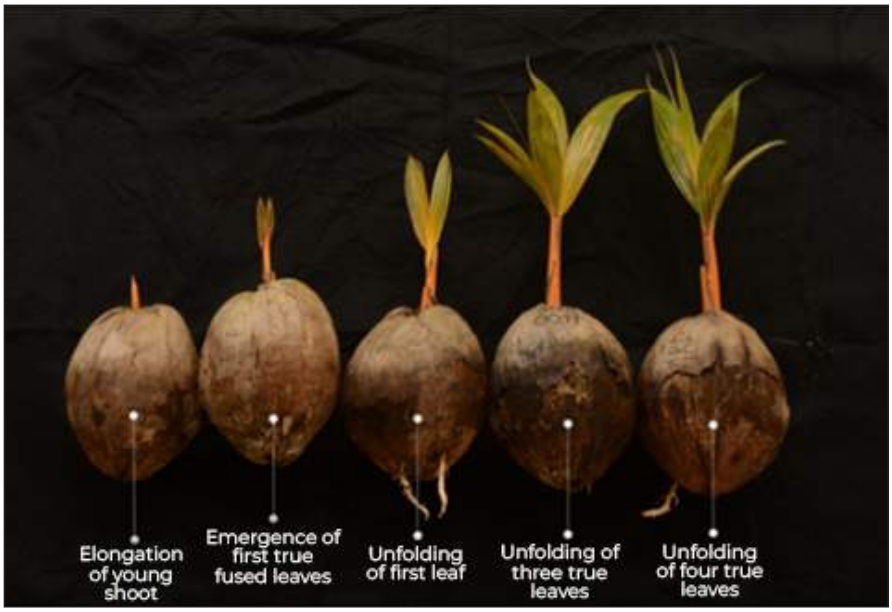
Phenology Studies, Crop Management, and Model Development for Coconut

Three treatments were applied consisting of 100 palms per treatment—T1 (control or farmer's practice), T2 (with irrigation), and T3 (Philippine Coconut Authority-recommended fertilizer rate and irrigation). Twenty palms per treatment were observed for productivity and quality parameters. It was observed that T3 had the highest average potential yield. In terms of coconut water quality, treatments had almost the same acidity but T2 has the highest total soluble solid (TSS). T3 exhibited the highest phenolic content, which is related to antioxidant properties.

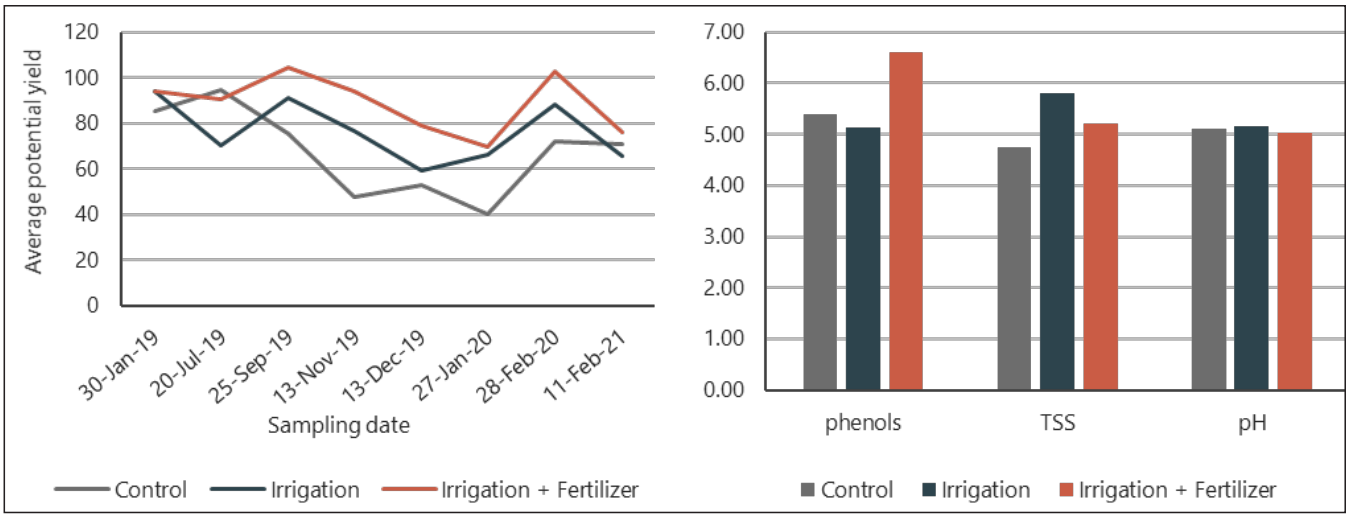
Among the selected dwarf varieties, Malayan Red Dwarf (MRD) requires the highest thermal points (tp) to develop five leaves while Tacunan Green Dwarf (TACD) requires the lowest, on the average. In the tall varieties, Laguna Tall (LAGT) requires the highest tp to develop a plumule and produce five leaves, while Tagnanan Tall (TAGT) requires the highest tp to produce fused leaves until the development of two leaves. Baybay Tall (BAYT) requires the lowest tp to develop five leaves on the average.



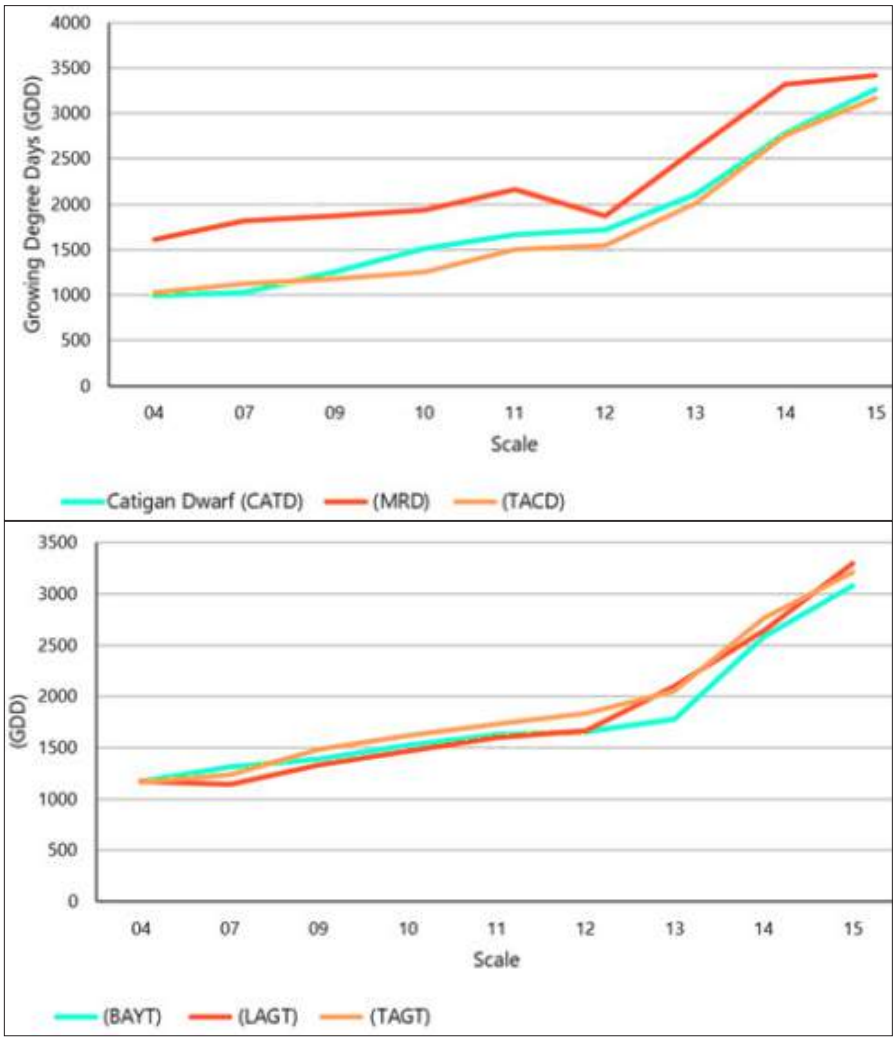
Seedling development of tall coconut variety. (Image credit: UPLB)



Seedling development of dwarf coconut variety. (Image credit: UPLB)



Average potential yield of coconut (left) and water quality (right) (phenolic content [g L-1], total soluble solid [TSS, °Bx], and pH) of tender coconut water under three treatments—T1 (gray, control/farmer's practice), T2 (blue-green, with irrigation), and T3 (orange, with irrigation and fertilizer).



Growth and development of six coconut varieties based on their GDD with base temperature of 13°C (top - dwarf variety, bottom - tall variety). (Image credit: UPLB)

Phenology Studies, Crop Management, and Model Development for Sugarcane

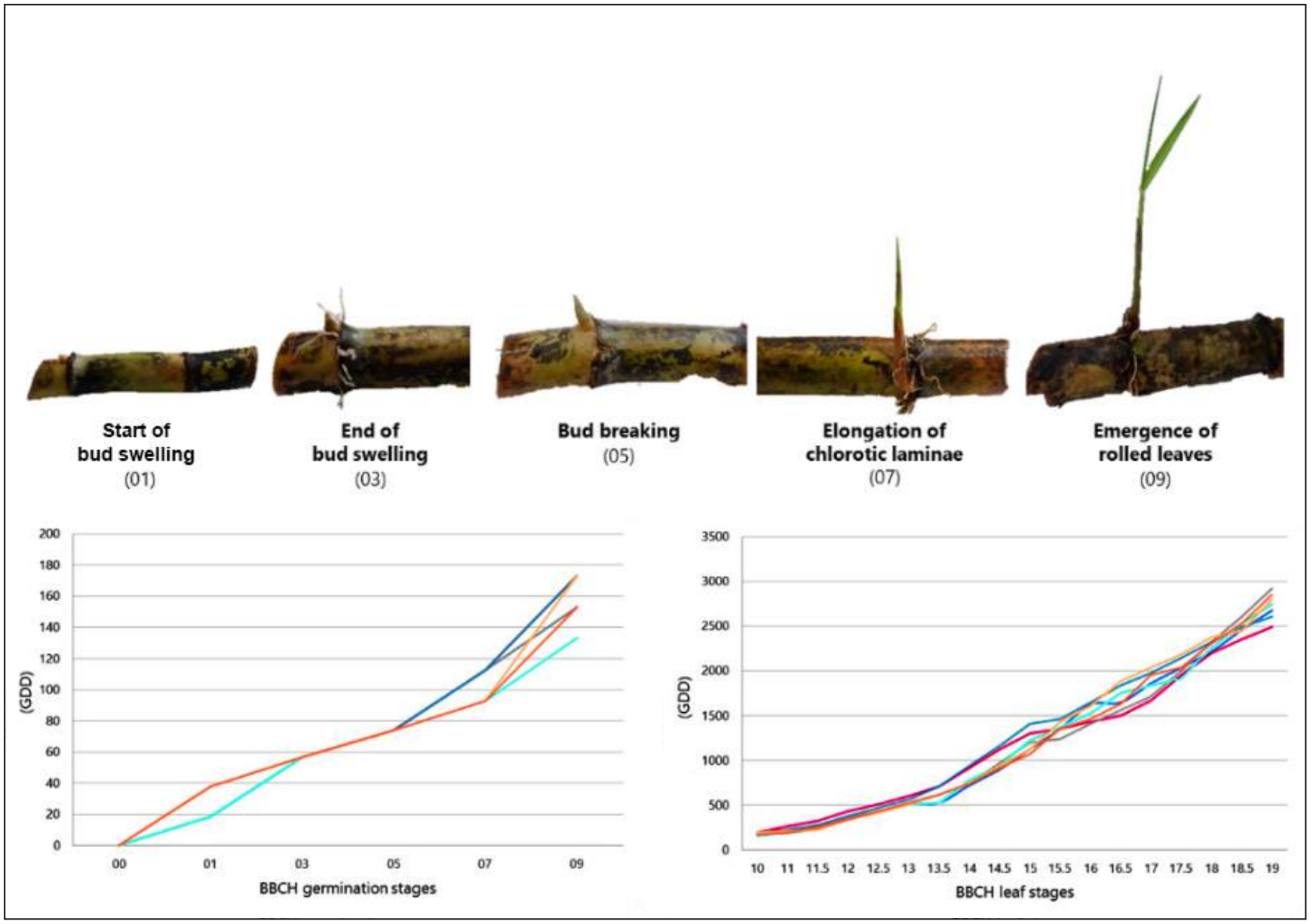
Phenology studies for sugarcane showed that based on the average number of days elapsed to reach a certain stage, the PSR-105 variety was the earliest to emerge from the soil at 6.4 days, while Phil 80-13 emerged at 9 days. In terms of leaf development, VMC 84-524 was the earliest to produce first true leaf, which, on average, took 8.4 days compared to Phil 80-13 which took 10 days. For the germination stage, on average, Phil-75-44, VMC 84-254, and VMC 84-947 had the highest growing degree days (GDD) of about 173 tp to achieve emergence of rolled leaves, while PSR-105 requires only 133 tp. Moreover, PSR-105 requires the lowest tp of 152 to develop its first true leaf while Phil-75-44, VMC 84-254, and VMC 84-947 needed 192 tp. On the other hand, to develop at least 18 fully expanded leaves, VMC 84-254 only needs an average of 2,603 tp while Phil 99-1793 needs an average of 2,919 tp.

In addition to phenology study setups, nutrient management experiments in UPLB and UP La Granja Research and Training Station (UPLGRTS) were laid out in a strip plot design with four replications using 5 treatments and 7 varieties in Table 9.

These observations only examine characteristics related to yield. Economic analysis will be performed once ratoon crop data are available to evaluate the experiment holistically.

Table 9. Result of nutrient management experiments in UPLB and UPLGRTS.

Parameter/Location	UPLB	UPLGRTS
Among the five treatments:		
Longest stalk and widest internode diameter	Sugar Regulatory Administration's recommended fertilizer rate (SRA RR)	NutrioTM + ½ SRA RR
Sugar recovery and tonnage	Farmer's practice	NutrioTM + ½ SRA RR
Highest variation in terms of sugar recover and tonnage	Farmer's practice	Farmer's practice
In treatment variety combination:		
Highest average stalk length	SRA RR + Phil 80-13	Farmer's practice
Highest average internode diameter	SRA RR + PSR 01-105	(NutrioTM + ½ SRA RR) + VMC 84-524
Highest tonnage	Farmer's practice + VMC 84-524	(NutrioTM + ½ SRA RR) + Phil 80-13
Highest sugar recovery	Farmer's practice + VMC 84-524	(NutrioTM + ½ SRA RR) + Phil 80-13



Growth and development of seven sugarcane varieties based on their GDD during germination (left) and leaf development stages (right) with base temperature of 9°C. (Image credit: UPLB)

Phenology Studies, Crop Management, and Model Development for Cacao

The best suited cacao production areas in the Philippines were determined by estimating cacao's yield potential when grown under climate Types II, III, and IV of the Modified Corona Classification (Table 10). Results showed that Type IV climate is the most suitable for cacao production with the highest potential yield even with water limitation. Type III climate areas are suitable when adequate irrigation is accessible.

Using the pod index of UF 18 (i.e., 20 pods to produce a kilo), the target yield of 2 kg dry beans per tree per year, as set in the Cacao Roadmap, was surpassed in the simulation by at least 200% in Type IV climate. It was likewise surpassed by the estimated actual yield. Cacao planted in Type II climate produced 0.52 kg/tree per year while cacao planted in Type III climate performed differently in each site. It was noted that the USM site had more solar radiation, higher temperature, and significantly lesser wind speed.

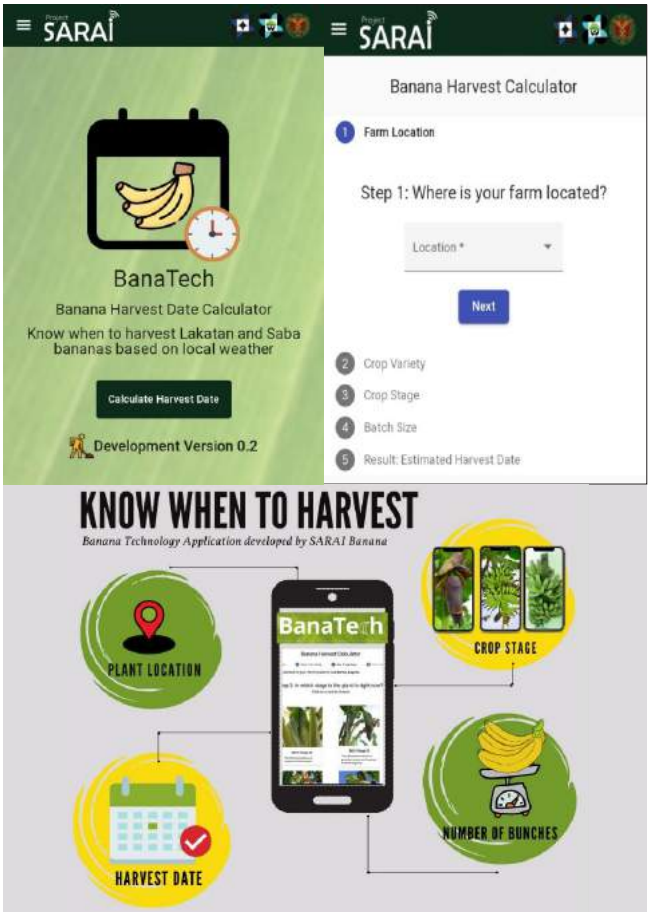
Phenology Studies, Crop Management, and Model Development for Banana

BanaTech is a harvest date estimator mobile application for banana. It will guide farmers and traders on when to harvest to meet particular market standards and minimize losses. It provides advisories by calculating the lakatan and saba bananas' expected harvest date. It also predicts the fruit development depending on temperature and contains a wide range of banana fruit development stages that can guide the farmer in the management and determination of fruit stage and other pertinent information about the fruit.

BanaTech has a predictability rate of 90.2% for cardaba/saba based on validation experiments at the UPLB Central Experiment Station (CES). For lakatan, a 95–96% predictability rate was validated at UPLB CES and Aborlan, Palawan. Since BanaTech uses a temperature-limited model, the days for those emerged from February garnered longer days of bunch development than those emerged on March and April. BanaTech is available at https://www.saraiapps.xyz/banana/.

Table 10. Potential yield of cacao per climate type and site.

Climate Type	Site	Potential Yield (kg per tree per year)
II	Real, Quezon	0.52
III	Narrahan Jamboree Site, UPLB, Los Baños, Laguna	1.13
	ICrops, UPLB, Los Baños, Laguna	1.40
	University of Science and Technology of Southern Philippines, Claveria, Misamis Oriental	1.85
	MinSU, Victoria, Oriental Mindoro	0.3
	USM, Kabacan, N. Cotabato	3.55
IV	Mintal, Davao City	4.27



BanaTech application and interface.

Evaluation of Crop Growth Simulation Model for Soybean

UPLB developed a crop model simulation for soybean and tomato growth and yield. To run the crop growth models, a minimum data set has to be inputted into the software program. Field experiments were established in various environments using five soybean varieties, namely: Tiwala 6, 8, and 10, Manchuria, and CLSo.

The developed model will be linked to the SARAI crop forecasting and advisory system to aid as a decision support tool for agricultural management practices. For instance, under Los Baños field conditions, the model simulated varying potential yields of Tiwala 6 variety at different planting dates during the 2021 dry season. Soybean had lower yield when planted in January than February because of the increase in dry matter production. However, the growth duration was longer during late planting due to the long daylengths. This simulated growth and yield for Tiwala 6 was based on optimum crop management wherein water and nutrients were non-limiting and actual weather data were utilized.

Developing Smart Environmental Resilience Solutions for Coastal Areas in the Philippines: Susceptibility, Adaptation, and Mitigation Measures

Gaps and issues in coastal resiliency were identified during the workshop spearheaded by the Batangas State University in cooperation with the Wolverhampton University in the United Kingdom (UK). A research framework and roadmap for the adoption and implementation of climate-smart technologies for resilient coastal communities was then crafted. This will help strengthen the capacity of local participants to understand the relevance of emerging technologies in environmental resilience and provide opportunity to develop multidisciplinary approaches for effective environmental resilience management of coastal communities.

Field experiments of soybean at UPLB.

Simultaneous workshop presentation and discussion between the Philippines and UK participants of Solutions for Environmental Adaptation of Coastal Areas in Philippines (SEACAP).

Philippine participants of SEACAP workshop.

Agenda 10: Strengthen Industry-Academe-Government and International STI Collaboration

Support to the Los Baños Science Community

The LBSCFI is a non-stock, non-profit organization composed of 24 member-agencies in the municipality. This year, the Laguna Water District Aquatech Resources Corporation (LARC) became a member of the Foundation.

The Council provided financial support to the annual SyenSaya: The Los Baños Science Festival—the local activitiy in celebration of the NSTW. Also, the Council facilitated the evaluation of R&D papers submitted for the different awards being conferred by the foundation.

The LBSCFI Information Committee, chaired by DOST-PCAARRD, also launched a webinar titled "Addressing the COVID-19 INFODEMIC: Straight from the Experts" on March 30, which aimed to create awareness among the Los Baños residents on the COVID-19 pandemic status in the municipality.

The LBSCFI Education Sector launched two projects to cater to students Grade 7–10: 1) "Review, Evaluation, and Revision of Grade 7–10 Mathematics and Science Assessment Tasks and the Development of Supplementary Grades 7–10 Mathematics and Science Learning Materials"; and 2) "Development of Mobile Reading Application for All Learners." These projects are being implemented in collaboration with the Department of Education Los Baños District.

Support to the Los Baños Science Community Local Partnership with Professional/ Scientific Organizations and Other Institutions

PCAARRD provides augmentation of funds and other forms of support to qualified organizations for pursuing S&T activities aligned with the Council's banner programs, priorities, and advocacies in the AANR sectors. These partnerships may be in the form of conferences, symposium, congress, forums, and the like. In supporting these S&T activities, DOST-PCAARRD is able to communicate R&D results; enculturate S&T to the youth; capacitate researchers and R&D personnel; advocate policy stance; and promote its corporate brand. For 2021, DOST-PCAARRD supported 22 S&T activities, 28 organizations and provided a total funding of P1.7 M among other forms of support. The list of activities and organizations supported is presented in Table 11.

Table 11. List of activities and organizations supported.

Name of Organizations	Title of Activity	Date of Activity
UP Business Administration Council and UP Career Assistance Program	Philippine Innovation Challenge (PIC) 2021: From the Ground Up	February 1, 3, 20, and 27, 2021
UPLB-College of Public Affairs and Development and Philippine Extension and Advisory Services Network, Inc.	Second International Conference on Governance and Development	March 23–25, 2021
UP Rural High School (UPRHS)	Engaging the Youth in Agriculture Program Lecture on Agricultural Policy and Socioeconomics	April 10, 2021
Philippine Agriculture and Economic Development Association (PAEDA)	PAEDA 1st International Conference and 51st National Convention	June 3–4, 2021
UPLB-College of Forestry and Natural Resources (UPLB-CFNR) - Department of Forest Products and Paper Science and UPLBFI	Dagta ng Buhay: The Philippine Almaciga e-talks	June 16 and 18, 2021
European Chamber of Commerce of the Philippines Northern Mindanao Business Council	Untapped Green Sector: Opportunities in the Bamboo Industry III	July 19, 2021
UPLB-College of Economics and Management (CEM)	Future Proof CEM: Harnessing Business and Economic Opportunities in the New Normal	July 27, 2021
Federation of Plant Science Associations of the Philippines (FPSAP)	2nd FPSAP Scientific Conference 2021	September 1–2, 2021
DA-National Fisheries Research and Development Institute	9th Fisheries Scientific Conference (Fish SciCon)	September 1–8, 2021

Table 11. (Continued)

Name of Organizations	Title of Activity	Date of Activity
Marine Environment and Resources Foundation Inc. and Marine Protected Areas Support Network	2021 Para el MAR (MPA Awards and Recognition)	September 8 and 10, 2021
UPLB Alumni Association	103rd Loyalty Day and Grand Alumni Homecoming	October 10, 2021
PhilFruits Association, Inc.	28th National Fruit Symposium Virtual Conference	October 12–13, 2021
DPGAA	2021 Virtual DPGAA Biennial Convention	November 3–4, 2021
Philippine Economic Society (PES)	59th Annual Meeting and Conference	November 11–12, 2021
Philippines Network of Educators on Environment	13th International Conference and Scientific Meeting	November 11–12, 2021
The Philippine Futures Thinking Society, Inc. (PHFutures)	Philippine Futures Summit: Futures of Education, Work, and Technology	November 12–14, 2021
UPLB-CFNR - Interdisciplinary Studies Center for Integrated Natural Resources and Environment Management and UP Veterinary Medicine Foundation, Inc.	3rd International Conference on Integrated Natural Resources and Environment Management (INREM 2021)	November 17–18, 2021
Department of Agribusiness Management and Entrepreneurship, College of Economics and Management (CEM), UPLB and College of Economics and Management Alumni Foundation, Inc.	3rd Global Agribusiness Management and Entrepreneurship (GAME 2021)	November 18–19, 2021
Philippine Community eCenter Network (PhilCeCNet)	16th Knowledge Exchange Conference (KEC16)	November 25–26, 2021
Asia Rice Foundation, Inc. (ARF)	ARF Annual Rice Science and Policy Forum 2021	November 30, 2021
Philippine Association of Research Managers, Inc. (PHILARM)	5th International Research, Development and Extension Management Congress and 29th National PHILARM Convention	December 9–10, 2021
International Society for Southeast Asian Agricultural Sciences (ISSAAS)-Philippine Chapter	2021 ISSAAS-Philippines National Congress	December 16–17, 2021

International S&T Related Activities Participated by PCAARRD Staff and NAARRDN Researchers, Scientists, and Experts

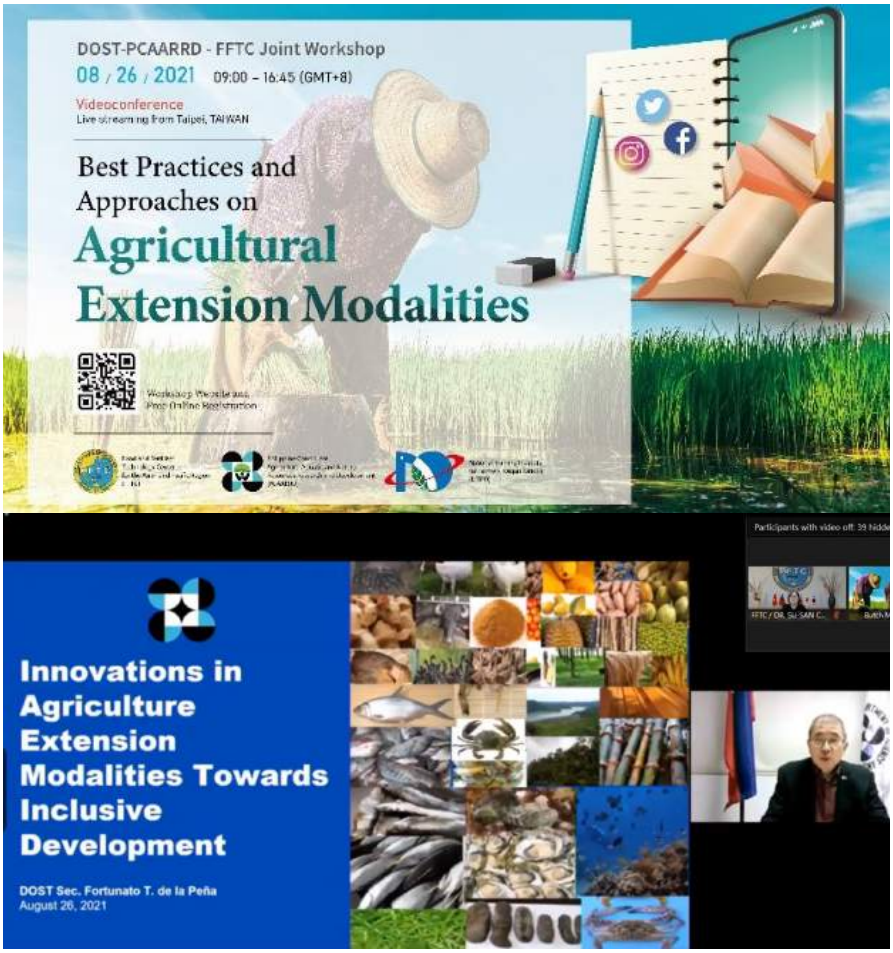
International Videoconference on Technology Transfer Modalities

The Council led the first International Videoconference on Best Practices and Approaches on Agricultural Extension Modalities on August 26 in collaboration with the Food and Fertilizer Technology Center (FFTC) for the Asian and Pacific Region and the National Training Institute for Farmers' Organization.

Among the presenters that included keynote speaker DOST Secretary Fortunato T. de la Peña were local researchers who presented three DOST-PCAARRD-funded initiatives The videoconference was held via Webex and FB Live and garnered 6,400 views and a total of 1,033 registered participants both on the FFTC website and the DOST-PCAARRD Events page.

Another forum titled, "A Celebration of LIFE (Livelihood Improvement through Facilitated Extension): A Commemoration of PCAARRD's 10th Year," showcased the impacts of the LIFE Model on the conflict-vulnerable communities in the country. It was held on June 22 via Zoom and FB Live. The forum highlighted how the LIFE program contributed to the significant change in the farmer's economic activity and livelihood through the sharing of experiences, lessons, and insights of the farmer groups, agency extension officers, and key LIFE partners.

The forum also featured the formal launch of the special LIFE Model Guidebook package which consists of a reference book, video library, and a training manual. The package provides information on how to incorporate the LIFE Model into agri-aqua extension programs.



DOST Secretary Fortunato T. de la Peña in his keynote speech during DOST-PCAARRD-FFTC International Conference on Best Practices and Approaches on Agricultural Extension Modalities.

The LIFE forum and LIFE book launching in South Cotabato.
(Image credit: Nikki Cordero)

ASEAN NEXT 2021: ASEAN Summit on Spin-off Technologies

Seven DOST-PCAARRD-supported technologies were pitched in the "ASEAN NEXT 2021: ASEAN Summit on Spin-off Technologies" on October 5 via Zoom and FB Live. The 1-day virtual event aimed to bring together RDIs, business and industry players, government, and academe in the Association of Southeast Asian Nations (ASEAN) who are involved in generating spin-off enterprises. The Council spearheaded the pitching session for the AANR sector. Local spin-off technology enterprises presented to an ASEAN-wide audience were Blitzkrieg Animal Diagnostic Kits, Juan Algae Paste, ACTICon™, botanical dewormer, ItikPINAS (AquChickBoy), Nutrio Biofertilizer, and tilapia ice cream. The event was attended by Philippine President Rodrigo Roa Duterte, ASEAN Secretary-General H.E. Dato' Lim Jock Hoi, and DOST Secretary Fortunato T. de la Peña, among others.

New Partnerships

Officially welcomed to the roster of DOST-PCAARRD international partners through the signing of agreements were the SEAMEO-SEARCA, JAF, and JxAAS of People's Republic of China and MSU in USA.

Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)

DOST-PCAARRD and SEAMEO-SEARCA renewed their partnership to develop and promote cooperation on education, training, research, technology transfer, and agri-incubation for the Philippines and the rest of Southeast Asia through a virtual Memorandum of Understanding (MOU) signing held on April 29. The renewed collaboration can be summed up as an academe-industry-government partnership to support, facilitate, and implement co-created and co-piloted agribusiness incubation, information, and technology transfer projects for the Philippines and Southeast Asia. Under the MOU, both parties committed to scientific and technological cooperation through joint R&D and support to technology transfer and commercialization research, implement capacity building activities such as scholarships, internships, mentoring, and research enrichment/sandwich training; joint conduct of and participation in scientific seminars, trainings, conferences, symposia, and workshops; and exchange of scientists and technical experts. The partnership will also include the exchange of IEC materials, as well as technical and scientific publications and information.

DOST-PCAARRD Executive Director Dr. Reynaldo V. Ebora (top middle) with DOST-PCAARRD Deputy Directors Dr. Feliciano G. Calora, Jr. (top right) and Dr. Melvin B. Carlos (top left) during the virtual MOU signing with SEARCA Director Dr. Glenn B. Gregorio (bottom) .

Jiangxi Academy of Forestry and Jiangxi Academy of Agricultural Sciences

A virtual signing ceremony of the MOU with JAF and JxAAS was held on September 6, via Zoom. The MOU was signed by DOST-PCAARRD Executive Director Dr. Reynaldo V. Ebora, JAF President Yang Jiefang, and JxAAS President Dai Xingzhao. The MOU is a product of the efforts of the Philippines' DOST and the People's Republic of China's Ministry of Science and Technology (MOST) who have been actively working together in identifying collaborative activities that will mutually benefit both agencies since 2017 during the 14th PH-China Joint Commission Meeting on Science and Technology. Bamboo postharvest processing and rice research were deemed as promising areas of cooperation for the revitalization of the existing S&T cooperation between the Philippines and the People's Republic of China.

Present to witness the MOU signing ceremonies are diplomatic representatives and DOST-PCAARRD implementing partners, DOST-FPRDI, CLSU, and Philippine Rice Research Institute (PhilRice).

DOST-PCAARRD Executive Director Dr. Reynaldo V. Ebora (top right) and Deputy Executive Director for R&D Dr. Feliciano G. Calora, Jr. (top left) with JAF President Yang Jiefang (bottom left), and JxAAS President Dai Xingzhao (bottom right) during the virtual MOU signing ceremony among DOST-PCAARRD, JAF, and JxAAS.

Participants from the Philippines and China during the virtual MOU signing among DOST-PCAARRD, JAF, and JxAAS.

Michigan State University

DOST-PCAARRD and MSU formalized their MOU on S&T Cooperation, focusing on biosensors and diagnostics, nanotechnology, biotechnology and biosafety, biological sciences, aquatic and marine sciences, and agricultural sciences. The modes of collaboration under the MOU include the exchange of materials in research and education; publications; academic information; and faculty, researchers, and scholars. It also included joint research and meetings for education and research and provision of technical assistance on identified focused topics under the partnership.

Active Partnerships and Regional Collaborations

Association of Southeast Asian Nations

ASEAN Committee on Science, Technology, and Innovation Sub-Committee on Biotechnology

Dr. Ebora, as the Philippine focal point of the ASEAN Committee on Science, Technology, and Innovation (COSTI) Sub-Committee on Biotechnology (SCB), assisted Dr. Rowena Cristina L. Guevara, national COSTI chair of the Philippines and DOST undersecretary for R&D in all related ASEAN COSTI collaboration activities. These include setting the direction, coordination of activities, reviewing the progress of collaboration, including the progress of its relations with the ASEAN's dialogue partners, as well as other external collaborators.

Dr. Ebora participated in the ASEAN COSTI-79 and Related Meetings held last June 15–17 virtually and hosted in Thailand. As the ASEAN COSTI SCB Focal Point, updates were periodically submitted to the Secretariat on various activities under the regional cooperation, namely:

- the ASEAN Network for Drugs, Diagnostics, Vaccines, and Traditional Medicines Innovation (ASEAN-NDI);
- the Diagnostics Development Hub: An Innovation Cluster Approach to Support Innovation and Enterprise;
- the formation of an ASEAN Dx Initiative;
- Health Technologies for Informed Decision-making of Local Governments in Three ASEAN Countries (HATID ASEAN);
- Harmonizing Biosafety Guidelines and Research Protocols on Biosafety in the ASEAN Region;
- ASEAN Conference on Harmonization of Biosafety Guidelines and Research Protocols for Agricultural Products Derived from Modern Biotechnology;
- Training of Experts from Cambodia, Lao PDR, Myanmar, and Brunei Darussalam on Genomics and Bioinformatics at the Philippine Genome Center;
- Capacity Building and Knowledge Sharing on Mushroom Production, Biofertilizer, and Composting Technologies in Different Farming Systems in the Philippines, Vietnam, and Thailand and Pioneering the Establishment of a Linked ASEAN Macrofungi Germplasm Collection; and
- Health Information Infrastructure, Governance, and Incipient Technologies in the ASEAN Region (HIIGIT ASEAN).

Dr. Ebora also endorsed several projects to the SCB as duly reviewed. The ASEAN Sero-surveillance Study was recommended to the Business Advisory Council to contribute to the ASEAN Comprehensive Recovery Framework and as part of ASEAN COSTI's 2021 Annual Priority. The "Accelerating Diagnostic Access Project (ADAP)," research funded by the Wellcome Trust, London School of Hygiene and Tropical Medicine, and the Chatham House, UK, was also endorsed to the SCB. This project aims to develop a potential regulatory policy framework for ensuring more timely licensing and introduction in the use of quality-assured diagnostic tests, and to consequently improve patient care, decrease antibiotic use, preserve antimicrobial drugs for future generations, and provide for more rapid and effective response to infectious disease outbreaks. The implementing agency for this project is the ASEAN-NDI.

Several projects were also reviewed and endorsed to the ASEAN Science, Technology and Innovation Fund, such as the HIIGIT ASEAN, proposed under the 2021–2022 Implementation Plan for the HIIGIT ASEAN Project Recommendations and the "ASEAN COVID Genomics Project."

As part of his duties, Dr. Ebora also requested Dr. Guevara the renewal of appointments of members of the 2nd ASEAN Dx Initiative Strategic Planning Panel, Dr. Reynaldo L. Garcia of UP Diliman, Dr. John Donnie A. Ramos of UST, and Dr. Gonzalo C. Serafica of UP.

Scholarship Offerings for ASEAN Researchers (Cambodia, Lao PDR, and Myanmar)

DOST continued its support to graduate students under the scholarship offerings for ASEAN researchers (Cambodia, Lao PDR, and Myanmar-CLM) despite the shift to flexible and blended learning in schools and universities. Implemented by the DOST-Science Education Institute (SEI) with DLSU-Manila, UPD, UPLB, and UPM, three MS scholars from Batch 1 have graduated during the second semester of the academic year (AY) 2020–2021. From Cambodia are Mr. Meta Mouy with MS Mechanical Engineering from DLSU-Manila, Mr. Samdy Hann with MS Environmental Engineering from UP-Diliman, and Mr. Dayuth An with MS in Public Health (Nutrition) from UP Manila. Batch 1 of scholars consisted of 14 MS and 4 PhD scholars, with 5 MS scholars already graduated as of 2021.

On the other hand, for Batches 2, 3, and 4, DOST-SEI monitors a total of 24 scholars/qualifiers with 14 MS and 10 PhD. Out of the 24 scholars, three from Myanmar already graduated this year—1 from UP Manila with an MS in Clinical Medicine, and 2 from UPLB with an MS in Agronomy and in Plant Breeding.

Australian Centre for International Agricultural Research

Despite the pandemic, DOST-PCAARRD and the Australian Centre for International Agricultural Research (ACIAR) continued to re-calibrate and collaborate closely in implementing various capacity-building programs participated by DOST-PCAARRD staff and members of the NAARRDN. It continued to represent the country's AANR concerns in the ACIAR Policy Advisory Council (PAC) and engaged with its diplomatic partners and ACIAR Philippines in monitoring its collaborative activities.

John Dillon Fellowship

The John Dillon Fellowship (JDF) is an opportunity for Filipino mid-career professionals in agricultural research to undergo intensive professional development training and other activities aligned with the program's goal of honing the leadership skills of the future generation of agricultural researchers in the country. JDF-Philippines is specifically designed to reflect DOST-PCAARRD's leadership and partnership priorities and to address the limitations of conducting a capacity-building program during the pandemic. DOST-PCAARRD and ACIAR closely collaborated to discuss the specifics of the program, in partnership with the University of New England (UNE). The JDF program has four core skills and learning modules: values-based leadership; collaboration and communication; project management; and gender equity and social inclusion.

Aside from the formal learning through the modules, the fellows developed their skills by producing a project proposal, to be presented for approval and funding of both DOST-PCAARRD and ACIAR, at the end of the program. In developing their project proposal, DOST-PCAARRD participated in the technical pitch-consultations. The initial pitch consultation aimed to help the Fellows refine their project plans and proposals in preparation for their final presentation to DOST-PCAARRD and ACIAR. The final pitch includes the project assessment panel composed of Dr. Ebora; Dr. Peter Horne, ACIAR general manager for country partnerships; and Ms. Eleneor Dean, ACIAR general manager for outreach and capacity building. Also present in the meeting are representatives from ACIAR and UNE.

Five project proposals, cutting across research themes on postharvest, value chains, gender, climate change, and agri-tourism, were presented and approved for funding. Twenty JDF-Philippines Fellows participated in the program.

Representation in the ACIAR Policy Advisory Council and Diplomatic Engagement

In the ACIAR PAC, the Council represents the concerns of the Philippines' AANR sector in the advisory body of the Australian government on policies and programs with respect to agricultural research. Dr. Ebora participated in the 41st ACIAR PAC Meeting held virtually on October 11–12. The discussion during the meeting focused on the outcomes and recommendations of the United Nations (UN) Food Systems Summit 2021, held on September 23, and the implications of those for Australia's support to international agricultural R&D.

DOST-PCAARRD has hosted several diplomatic visits from the Australian government in the past, giving the opportunity for both parties to discuss the status and updates of its collaborative activities and advocate for the continued

support for its partnership. Last July 30, the Australian Embassy in the Philippines Deputy Head of Mission Richard Sisson visited the Council and shared his optimism and enthusiasm in getting to know DOST-PCAARRD as an institution. Deputy Ambassador Sisson also shared the Australian government's planned Civil Maritime Program that aims to support the Philippines in protecting its maritime interests and in ensuring benefit from the sustainable management of its marine resources. DOST-PCAARRD submitted its inputs and proposed areas of collaboration.

The visit coincided with the ceremonial launching of the publication, the "ACIAR Impact Assessment Series No. 102: An Integrated Approach to Ex-post Impact Assessment," during the 43rd anniversary of UPLB-CEM. The publication, a collaboration between DOST-PCAARRD, ACIAR, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), VSU, and UPLB, is a corpus of lessons and experiences in analyzing the outcomes from agricultural research-for-development investments. The product is an integrated, mixed-method approach to impact assessment specific to the AANR sector.

Coordination with ACIAR Philippines

DOST-PCAARRD and ACIAR, through its country office in the Philippines, practice self-reflexivity on the status of its partnership and in monitoring and evaluating its programs and projects. Last January 12, the 2nd ACIAR-PCAARRD Partnership Health Check was held virtually as a strategy to periodically monitor and assess the partnership.

The meeting also provided the venue for a thorough discussion on the needed adjustments in implementing joint R&D programs/ projects and capacity-building activities during the pandemic.

On November 25, Dr. Ebora welcomed the new ACIAR country manager for the Philippines, Ms. Hazel Aniceto. Several consultation meetings regarding various ongoing and proposed projects on coral reef restoration (under the Australian government's Civil Maritime Program) climate change, and sustainable smallholder dairy sectors were conducted before the end of the year.

On December 13, DOST-PCAARRD held a consultation meeting with ACIAR to discuss the proposed project, "Building Systematic Resilience in Aquaculture through Accelerating Innovation Systems."

ACIAR Philippines also facilitated the interview with Dr. Ebora by Ms. Judy Kennedy of Currie Communication, a commissioned writer for ACIAR's 40th-anniversary book set for 2022. The interview, held last December 23 via Zoom, allowed Dr. Ebora to share the history and nature of the DOST-PCAARRD-ACIAR partnership and its success stories in nurturing research and diplomatic collaborations in the region.

Delegates from the Australian Embassy and DOST-PCAARRD executives during the visit of Australian Deputy Ambassador Richard Sisson (second from the right) to DOST-PCAARRD on July 30.

DOST-PCAARRD and ACIAR attendees during the 2nd Partnership Health Check last January 12.

DOST-PCAARRD held a consultation meeting last December 13, to discuss the proposed project, "Building Systematic Resilience in Aquaculture through Accelerating Innovation Systems."

Asia-Pacific Association of Agricultural Research Institutions

DOST-PCAARRD participated in various activities of the Asia-Pacific Association of Agricultural Research Institutions (APAARI). The Council provided inputs and feedback on its various activities related to forward planning and organizational assessment such as the revised guidelines on the General Assembly Meeting (GAM), the survey conducted by the Commission on Sustainable Agricultural Intensification (CoSAI) Taskforce on Principles and Metrics for Innovation in Sustainable Agri-food Systems, and the APAARI Membership Satisfaction Survey. Dr. Lilian Bondoc, director of the DOST-PCAARRD's Policy Coordination and Monitoring Division (PCMD), also represented Dr. Ebora in APAARI Country Core Members Meeting held on October 26 to discuss the Association's accomplishments and programs for the next year.

On the other hand, APAARI, in collaboration with the Council; the Council of Agriculture (COA), Taiwan; CropLife Asia (CLA), Singapore; and the Federation of Seed Industry of India (FSII), India, conducted the "Virtual Regional Workshop on Investment in Modern Agricultural Biotechnology and its Socioeconomic Impact on Livelihoods of Farmers in Asia Pacific," held last August 2–3. The regional symposium aimed to assess the investment in agri-biotechnology and its impacts on livelihoods of farmers in the Asia-Pacific Region; scope innovative ways of enhancing the investment in important areas of agri-biotechnology in the Asia-Pacific Region; and discuss how to enable and support, through government policies, to attract investors from the private sector for R&D and to promote agri-biotechnologies in the region.

The Council also continued to contribute articles to the APAARI Newsletter, specifically highlighting the "GALING-PCAARRD Kontra COVID-19 Program" in the APAARI Newsletter for the first semester of 2021.

Moreover, DOST-PCAARRD expressed its support and endorsement of Dr. Ravi Khetarpal, APAARI executive secretary, as chair of the Global Forum on Agricultural Research and Innovation (GFAR). Dr. Khetarpal was appointed on November 11, giving the opportunity for DOST-PCAARRD to widen its platform, advocacy for AANR concerns, and network through APAARI and its role in the GFAR.

e-ASIA Joint Research Program

DOST-PCAARRD, together with other member organizations and led by DOST, participated in the e-ASIA Joint Research Program 10th and 11th Call of Proposals in 2021. The 10th Call in the field of Environment had four successful program/project proposals from the DOST-PCAARRD network endorsed and approved during the Joint Review Meeting held last August 31. The announcement of the results was disseminated last December 15. Successful proposals will go through the DOST-PCAARRD review and evaluation process prior to implementation during the first quarter of 2022.

For the 11th Call in the field of Advanced Interdisciplinary Research towards Innovation on the topic of greener digital cities,

DOST-PCAARRD signified its interest to join in the said call and participated in the joint drafting of the Call's guidelines. Dr. Juanito Batalon, director of the Agricultural Resources Management Research Division (ARMRD) acted as the focal person in the working group on the topic greener digital cities and participated in a virtual workshop held last November 29 and December 1 to promote the exchange of research activities, share information, and discuss potential international collaborative research under the said topic. The 11th call will officially launch on March 15, 2022.

Food and Fertilizer Technology Center for the Asian and Pacific Region

The Council joined the historic virtual celebration of FFTC's 50th Anniversary and Symposium titled, "Making Agri-food Systems Sustainable" last October 6 in support of one of DOST-PCAARRD's steadfast partners. The event was attended by FFTC's institutional partners and with a congratulatory message from Taiwan President Tsai Ing-wen.

Dr. Ebora served as moderator in the session, "Nourishing Asia's Growing Population," which provided the opportunity to discuss the intricacies and the prospects of sustainable agri-food systems. He also moderated Harbest Agribusiness Corporation president Arsenio Barcelona's presentation titled, "4.0 Agricultural Revolution: Precision Farming with Smart Agriculture—The Philippines Condition". Likewise, Dr. Ernesto Brown, director of the Socio-Economics Research Division (SERD), served as a panelist during the "Agricultural Policy Forum—Moving Towards Sustainable Agri-food Systems Under and Beyond the COVID-19 Pandemic" with Dr. Miyuki Iiyama, program director, Information Program at the Japan International Research Center for Agricultural Sciences (JIRCAS) and Dr. Song Soo Lim, professor, Department of Food and Resource Economics at the Korea University.

As a member of its technical advisory committee, Dr. Ebora attended the 106th executive board meeting on December 7 as a virtual observer. Dr. Ebora expressed his appreciation for the Center's efforts in effectively collaborating with all its partner institutes and agencies in different countries and lauded the center's Agricultural Policy (FFTC-AP) Platform to which the Council has been an active contributor to the FFTC-AP since its inception.

Manila Economic and Cultural Office-Taipei Economic and Cultural Office and the Industrial Technology Research Institute

DOST-PCAARRD participated in the 7th MECO-TECO Joint Science and Technology Commission (JSTC) meeting last December 3, which was organized by Taiwan's MOST. The JSTC meeting was convened to discuss the progress of the S&T cooperation and map out plans between Taiwan and the Philippines. DOST Secretary de la Peña and MOST Minister Tsung-Tsong Wu led the meeting. Dr. Bondoc virtually represented Dr. Ebora.

Aside from the presentation of status and accomplishments reports of collaborative projects undertaken under the partnership, priority areas were identified for the 2022 MECO-TECO Joint Call for Proposal.

The DOST-MECO-TECO partnership is also instrumental in establishing the engagement between DOST-PCAARRD and the Industrial Technology Research Institute (ITRI). On December 20, a partnership meeting was held virtually that leveled off the expectations and goals of the DOST-PCAARRD-ITRI collaboration. It was an opportunity for the initial discussion on proposed areas of the collaboration such as agriculture intelligent system; biochar composite material technology for bamboo, rice, coconut, coffee, and cacao; and carrier entrapped technology for various applications including aquaculture.

Rural Development Administration

One applied communication expert (ACE) was dispatched to Rural Development Administration (RDA) as part of the implementation of the 2021 ACE Program despite the uncertainty and restrictions of international travel during the pandemic. Dr. Engelbert R. Lalican, a senior science research specialist of TTPD, successfully and safely performed his duties as ACE at RDA from August 16 to December 13. The ACE provides support, assistance, and advice on quality documentation and applied and corporate communication of RDA and conducts a GTIS activity at RDA; represents DOST-PCAARRD and serves as its liaison officer at RDA during his/her assignment, and contributes to revitalizing and strengthening the partnership through his/her recommendations.

S&T Partnerships Review and Advice

DOST-PCAARRD reviewed proposed S&T collaborations, provided relevant S&T partnership advice to DOST and other partners, and provided recommendations on areas that can be pursued to boost its international partnerships

and linkages. These inputs are used as primary references for DOST in maximizing partnership opportunities whether with bilateral or multilateral partners and international organizations.

The Council reviewed draft agreements, provided inputs on possible collaboration activities and other references such as historical briefs, partnership insights, and updates on the status of partnerships on 22 activities. Likewise, DOST-PCAARRD was requested to review and provide inputs in five proposed monitoring and evaluating (M&E) strategies, procedures, and guidelines related to its partnership activities.

Dissemination of Opportunities from International Partners and other Related Information

DOST-PCAARRD also extended to its networks various opportunities for collaboration and participation in 17 organized events and activities promoted by its partners and received from DOST.

Visitor's Program

Delegates from the United States Department of Agriculture (USDA), Agricultural Counselor Morgan Haas, and Agricultural Specialist Florence Sevilla were safely welcomed to the DOST-PCAARRD headquarters last September 2. Dr. Ebora and Dr. Calora, Jr. led the welcoming and briefing of the USDA delegates. Dr. Bondoc introduced to the delegates the Council and its mandates and presented a brief background on the collaboration between the Philippines and the US, through the engagement between DOST-PCAARRD and US government agencies/institutions such as USDA. In the past, engagements between the Council and USDA has been limited to information exchanges. Dr. Bondoc expressed her hope that through the visit, more active collaboration can be discussed, especially with the requested discussion of USDA focusing on biotechnology and climate change. Dr. Allan B. Siano, officer-in-charge (OIC) of the Crops Research Division (CRD), presented DOST-PCAARRD's projects and activities on biotechnology, while Dr. Marcelino U. Siladan, senior science research specialist of the Forestry and Environment Research Division (FERD) presented the ISP on Climate Change, including disaster risk reduction and management, on behalf of FERD Director, Leila C. America who joined the meeting virtually. The USDA delegates appreciated the presentations and expressed their optimism in the alignment of USDA to DOST-PCAARRD priorities.

Delegates from the USDA and DOST-PCAARRD executives, directors, and ISP manager during the USDA appreciation visit.

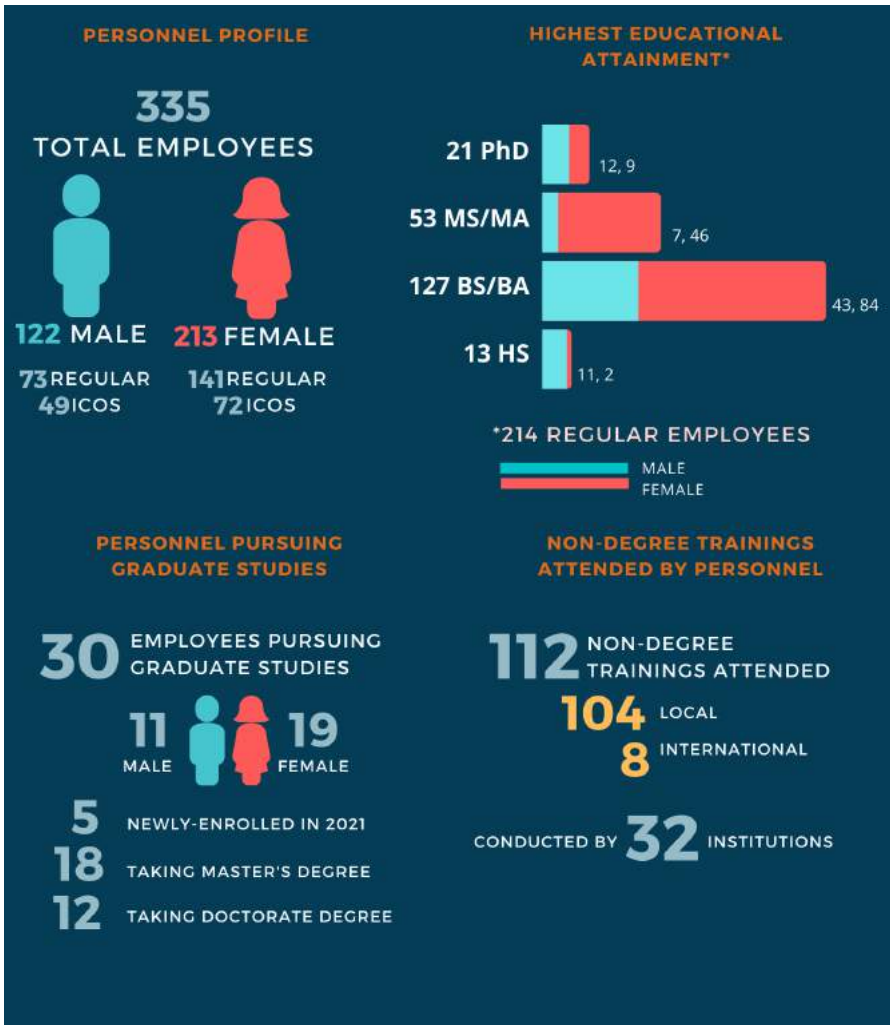
Agenda 11: Enhance Effectiveness of STI Governance

Human Resource Management

This year's accomplishments are due to the hard work and dedication of DOST-PCAARRD's 214 regular and 121 Institutional Contract of Service (ICOS) staff. From its regular staff, the Council now has 21 PhD and 53 MS holders. Currently, there are 29 employees pursuing graduate studies with five newly-enrolled in 2021.

This year, Dr. Allan B. Siano also obtained his Doctor of Philosophy in Horticultural Science from Massey University in New Zealand.

Dr. Allan B. Siano graduated from Massey University, New Zealand.



Five new DOST-PCAARRD scholars. (From left) Kristine Ann C. Aranguren (Master in Public Affairs major in Strategic Planning and Public Policy, UPLB), Alexander John D. Borja (Master in Technology Management, UP Diliman), Kristine Joy P. De Guzman (Master in Plant Pathology, UPLB), Michelle A. De Vera (Master in Fisheries major in Fisheries Biology, UP Visayas), and Cyrill E. Lim (Master in Public Affairs major in Strategic Planning and Public Policy, UPLB)

Non-degree Trainings Participated by DOST-PCAARRD Personnel

Table 12. Trainings participated by DOST-PCAARRD staff in 2021.

Staff Trainings 2021	
Title of Training	
Local	
Association of Government Internal Auditors, Inc. (AGIA)	Accounting Policies, Guidelines and Procedures for National Government Agencies (NGAs)
	Basic Accounting for Non-accountants
	Guiding Principles on the Management of Government Funds and Properties (Laws and Regulations for Government Expenditures)
	Internal Control System for Property and Supply Management (Appraisal and Disposal)
	Preparation of Project Procurement Management Plan (PPMP) and the Annual Procurement Plan (APP)
Asian Institute of Journalism and Communication (AIJC)	Scriptwriting for Audio Visual Materials
	Technical Writing and Editing
Asian Media Information and Communication Centre (AMIC)	28th Annual Conference
Beacon	ISP-Information System (IS) Knowledge Transfer Training (Modules 1–3)
Career Executive Service Board (CESB)	CES Leadership Conclave
	CES Lifelong Learning for Leadership Congress 2021
CISCO	CISCO Turn It Up
Civil Service Commission (CSC)	CSI Public Sector HR Symposium Transforming Government Agencies Into Smart Organizations: Honing Resilient and Future-ready Public Servants
	CSI Public Service Values in Times of Adversities
	CSI Webinar on Public Service Value
	Leave Administration Course for Effectiveness (LACE)
Civil Service Institute (CSI)	Coaching and Mentoring
	CSI Leadership Series: Public Service Values in Times of Adversities
	CSI Leadership Training on Emotional Intelligence and Leadership
	CSI Public Service Values in Time of Adversities
	Public Sector Symposium, Transforming Government Agencies into Smart Organizations: Honing Resilient and Future-ready Public Servants
CVAARRDEC	Enhancing the Capabilities of Central Visayas Agriculture, Aquatic and Natural Resources Research and Development Consortium (CVAARRDEC) Consortium Member Institutions (CMIs): The Knowledge Management Agenda for AANR
Development Academy of the Philippines (DAP)	DAP Graduate School's Certificate Course on the Foundation of Knowledge Management (KM)
	Online Training Course on KM Training Batch 3
Department of Budget and Management (DBM)	Budget and Treasury Management System (BTMS) Catch Up Training
DELL	Dell Technologies Power Your Future
	Dell Technologies Virtual Webinar
Department of Information and Communications Technology (DICT)	Focus Group Discussion on the Competency Needs Assessment and Training Needs Analysis for the Digital Workforce

Table 12. (Continued)

Title of Training	
Local	
DOST	CY 2021 Records Management Forum (Webinar on Counter Disaster Records Recovery and Business Continuity
	Dry Run Session as per DOST Project Management Information System (DPMIS) Nationwide Call Conference
	Learning and Development (L&D) Courses
DOST Internal Audit Service (IAS)	Public Financial Management Competency Program (Part 1)
DOST-PCAARRD	Awareness Webinar on ISO 9001:2015 Quality Management System Standards
	Derwent Innovation Users' Training: Patent Mining Program for Selected AANR Commodities through Strengthened IP-TBM Offices
	Gender Sensitivity and Gender-based Discrimination in the Workplace
	How to Get Key Decision Makers to Say YES to Your Project Ideas: A Training Course for Project Implementers
	How to Use StreamYard Effectively for Online Events
	HRMS Training for the Division Staff
	Human Resources Management System (HRMS) Training for Division Marshals
	ICT Focal Training on Virtual Events
	Online Training on Hosting Virtual Meetings, Seminars and Trainings
	Quick Response Team Refresher Course
	QRT Refresher Course (First Aid/Basic Life Support)
	Quick Response Team (QRT) Refresher Course (Earthquake Preparation and Response)
	Quick Response Team (QRT) Refresher Course (Fire Prevention and Emergency)
	QRT Refresher Course (Public Service Continuity Plan [PSCP] and Emphasize the QRT's Role)
	RIRR Webinar on RA 9184
	Strategic Foresight and Scenario-Strategy Development Masterclass
	Training on Customer Satisfaction Management
	Training on Documented Information Control
	Training on Hosting Virtual Meetings, Seminars and Trainings
	Training on Internal Quality Auditing and Reporting
	Training-Workshop on Media Relation
	Training-Workshop on Thesis Presentation
	Training-Workshop on Thesis Writing
DOST-PCAARRD and ACIAR	A Celebration of LIFE
DOST-Region II	HRDP funded training: Communication Skills: Importance and Effects in the Organization
DOST-Science and Technology Information Institute (STII)	Accelerating Knowledge Network of eLibraries
	Control your Records Before they Control You: The Basics of Records Management and Records Control

Table 12. (Continued)

Title of Training	
Local	
E-Blackboards Learning and Solutions, Inc.	PhilGEPS Training (Phase 1)
Elsevier	Best Practices in Writing and Publishing your Research Paper
Fortinet	Fortinet Introduction
Government Association of Certified Public Accountants (GACPA)	42nd Annual National Convention and Webinar
Government Procurement Policy Board (GPPB)	Updates of Revised Implementing Rules and Regulations (RIRR) of RA 9184
HRDP Committee	3rd Human Resource HRDP Workshop: Boosting HR Officers' Competencies, Enhancing L&D Interventions for a More Resilient DOST Workforce
Human Resource Innovations and Solutions, Inc. (HURIS)	CESB Accredited Virtual Leadership Training Programs for 2021 (Building Powerful Teams)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Coaching: Raising Performance to the Next Level)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Driving Execution)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Effective Conflict Resolution and Solving Employee Performance Issues thru Mediation)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Essentials of Managing Change and Employee Transition)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Managerial Leadership)
	CESB Accredited Virtual Leadership Training Programs for 2021 (New Leadership Style for the 21st Century)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Strategic and Critical Thinking)
	CESB Accredited Virtual Leadership Training Programs for 2021 (Thinking out of the Box: Embracing Innovative Leadership)
	New Leadership Style in the 21st Century
	Thinking Out-of-the-Box: Embracing Innovative Leadership
Insafety, Inc.	Basic Occupational Safety and Health (BOSH) Training for SO1
	BOSH Webinar
National Privacy Commission (NPC)	Data Protection Officer (DPO) ACE Level 1 Certification
International Institute of Rural Reconstruction	Scaling Out Climate Smart Agriculture via Climate Smart Villages Part I
Philippine Association for Agriculturists, Inc. (PAA)	2021 Philippine Agriculturists' Summit
Philippine Association of Records Officers and Archivists	Virtual Training/Seminar on RA 9184 and Its RIRR
PhilCECNet	Knowledge Exchange Conference 16
PIDS-SERP-P	Philippine Institute for Development Studies (PIDS)-Socioeconomic Research Portal for the Philippines (SERP-P) Public Webinar on "Less Noise, More Facts: Improving Information Dissemination for a Better New Normal"

Table 12. (Continued)

Title of Training	
Local	
Public Information and Promotion Division (PIPD) Office for Alternative Dispute Resolution (OADR)	2nd National Alternative Dispute Resolution Convention
	OADR Webinar Series, Season 2 Episode 10: Alternative Dispute Resolution in the Government
PLDT	SMART Solutions
ProcessMaker	Accelerating Digital Transformation with Low-code
Public Relations Society of the Philippines	27th National Public Relations Congress
Philippine Society of Agricultural and Biosystems Engineers, Inc (PSABE)	17th International Agricultural and Biosystems Engineering Conference and the 70th PSABE Annual National Convention
Philippine Society of Mechanical Engineers (PSME)	69th PSME National Convention
STRAT one	Designing and Implementing a Monitoring and Evaluation System Workshop
	Statistical Analysis Using R
UPLB-Institute of Computer Science	Seminar on VM Host Server Setup: Installation and Configuration
Title of Training	
International	
ACIAR	Meryl Williams Fellowship 2021 Cohort
APEC and DOST	Asia-Pacific Economic Cooperation (APEC) Project Management Virtual Training
Crawford Fund	Crawford Fund e-Mentoring Program
DAP and Asian Productivity Organization	Training Course on Innovative Aquaculture Models Korea Maritime Institute
DOST-PCAARRD	IP Conference Training: Driven Development of Green Niche to Be a Trendy Entrepreneur for Green Investor Digital
	Internet Protocol (IP) Conference Training "Keynote Plenary on "Artificial Intelligence: A Game Changer for IP Regimes"; Discussion on Intangible Assets: Powering the Future of Global Business Transactions; Discussion on Innovation Elevated Taking Your Business to the Next Level through IP Services
Korea Maritime Institute	Online GIS Training Program
UN Food Systems Summit	Transforming Food Systems and Combating Climate Change: A Virtual Event Post-COP6 and Beyond

The Council had 10 retirees, 18 service awardees, and 15 recipients of performance excellence award. They were honored during the 2021 Recognition Ceremony held at the EO Tan Hall on December 21.

SERVICE AWARDEES

Melvin B. Carlos
OED-ARMSS, 10 Years

Rita Rowena B. Laquinon
IDD, 20 Years

Noel A. Catibog
TTPD, 25 Years

Dorefel M. Ingco
FAD, 25 Years

Wilmar J. Lastimosa
IDD, 25 Years

Alex G. Calibo
FAD, 30 Years

Rosalinda D. Escarez
MRRD, 30 Years

Angelito N. Medina
FAD, 30 Years

Victoria Athena D. Peralta
OED, 30 Years

Anna Marie P. Alo
LRD, 35 Years

Rhodora G. Camposano
FAD, 35 Years

Aleli R. de Juras
FAD, 35 Years

Marina T. de Ramos
ACD, 35 Years

Audrey O. Lapitan
TTPD, 35 Years

Faustina C. Baradas
FERD, 40 Years

Susan L. Garcia
FAD, 40 Years

Isabel G. Lantican
FAD, 40 Years

Yolanda M. Tanyag
TTPD, 40 Years

Felicidad E. Bautista
CRD, 40 Years

PERFORMANCE EXCELLENCE

Management Excellence

Noel A. Catibog
Chief SRS, TTPD
Most Outstanding

Mari-Ann M. Acedera
Chief SRS, MRRD
1st Runner-up

Ernesto O. Brown
Chief SRS, SERD
2nd Runner-up

Senior Technical Category

Mia Barbara DV. Aranas
Senior SRS, SERD
Most Outstanding

Abigail F. Gueco
Senior SRS, TTPD
1st Runner-up

Ronilo O. De Castro
SRS II, LRD
2nd Runner-up

Senior Administrative Category

Arminda S. Atienza
AO IV, FAD
Most Outstanding

Anna Cristina R. Samonte
AO IV, OED-RD
1st Runner-up

Glenda P. Lantacon
AO IV, FAD
2nd Runner-up

Junior Technical Category

Azel Glory C. Banganan
SRS II, PCMD
Most Outstanding

Mae A. Dagaas
SRS II, TTPD
1st Runner-up

Eugenio G. Afalla, Jr.
SRS II, OED-RD
2nd Runner-up

Junior Administrative Category

Georgia M. Lawas
AO IV, FAD
Most Outstanding

Heidelita A. Ramos
AO II, FAD
1st Runner-up

Leandro C. Lameyra
Admin. Asst. III, OED-RD
2nd Runner-up

Financial Resources Management

The Council managed a budget of P1.480 B in 2021, that includes P1.453 B for current appropriations and P27 M for continuing appropriations. Of this total budget, P16 M were additional releases from the Department of Budget and Management for performance-based bonus (PBB) and authorized employer's share on retirement insurance. The 2021 appropriations also included P55 M as congressional initiative intended to support COVID-19-related projects.

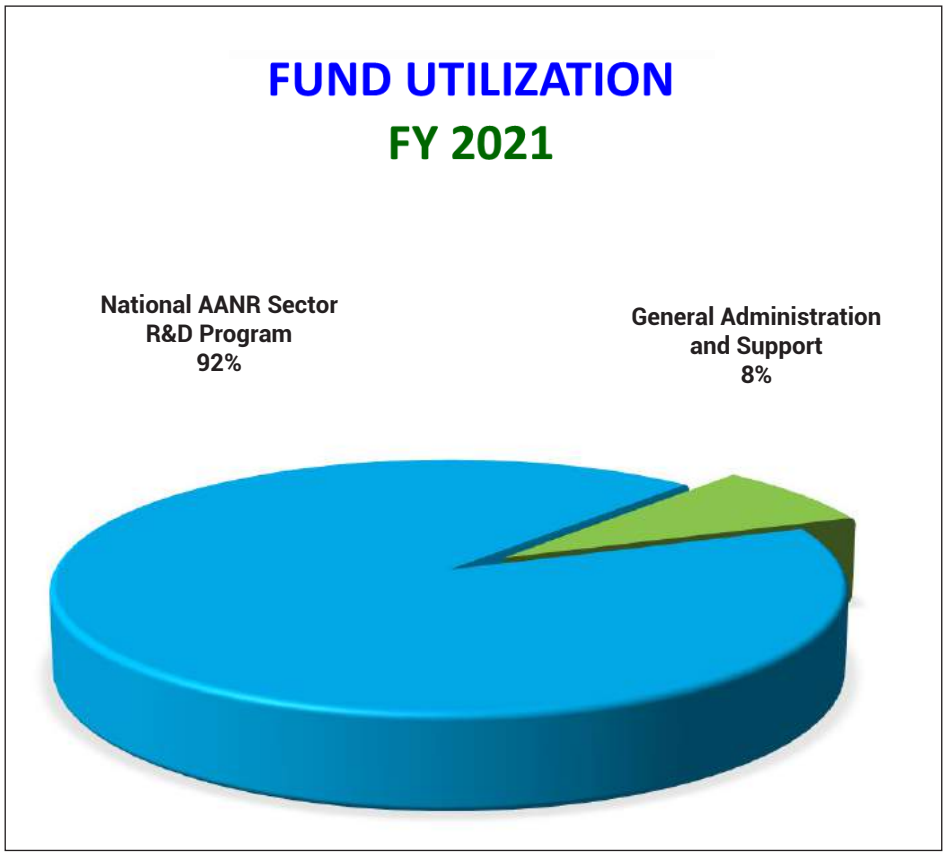
The current year and prior year appropriations were duly obligated to programmed projects and activities and reached fund utilization rate of 96% and 80%, respectively. A total of P1.305 B or 92% of the funds went to support the AANR sector R&D program, which contributed to the attainment of the Organizational Outcome: Increased Benefits to Filipinos from Science Knowhow and Tools for Agricultural Productivity in the AANR Sector. DOST-PCAARRD released funds totaling P1.116 B to various implementing agencies nationwide to support priority R&D projects. Financial M&E activities, as well as financial management seminars were vigorously conducted with the implementing agencies to facilitate the immediate liquidation of these funds. The remaining unused appropriations were forwarded as continuing appropriations, which is valid for obligation until December 31, 2022 pursuant to RA 11640.

The Council utilized a P943-M cash allocation during the year covering the payment of current and prior year's obligations. The total disbursements covered 67% of the total obligations. The cash allocation was carefully managed to ensure that all priority expenditures were settled.

In addition to the annual appropriations, DOST-PCAARRD managed P92.276-M funds held in trust received from local sources to support and monitor projects and activities. This amount consisted of P57.917 M remaining balance from 2020 and P34.358 M generated in 2021. Of this amount, P49.773 M or 54% was utilized during the year, with P39.903 M or 80% spent for R&D activities. The unexpended portion of the fund will be used to sustain ongoing projects and activities in 2022.

Resources Generation

The Council generated about P38,127,026.53 from external sources, accounting both in cash (P34,704,350.53) and in kind (valued at P3,422,676).



Continual Improvement

DOST-PCAARRD's Quality Management System (QMS) obtained its ISO 9001:2015 re-certification after successfully completing all the requirements set by SOCOTEC Certification International, its external certifying body. The Internal Quality Audit conducted from June 28 to July 16 prepared the Council for its re-certification audit conducted on August 19.

The following capacity-building activities were conducted virtually:

1. ISO 9001:2015 QMS Awareness (January 12 and 13);
2. Training on Internal Quality Auditing and Reporting (March 4–5);
3. Training on Documented Information Control (October 20 and 27); and
4. Training on Customer Satisfaction Management (November 23).

The activities were participated by 86, 30, 58, and 67 DOST-PCAARRD staff, respectively.

In terms of customer satisfaction, from all the external and internal services, which PCAARRD have gathered its customer feedback, the Council received a rating of 4.82 in terms of responsiveness, 4.82 for reliability (quality), 4.79 for access and facilities, 4.82 for communication, 4.84 for integrity, 4.84 for assurance, and 4.85 for outcome; hence, a 4.83 overall score for 2021, equivalent to outstanding.

CERTIFICATION INTERNATIONAL
SOCOTEC

CERTIFICATE

No. SCP000122Q

certifies that :

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)

Paseo De Valmayor, Economic Garden, Brgy. Timugan Los Baños, Laguna, 4030 Philippines

operates a management system that has been assessed as conforming to :

ISO 9001:2015

for the scope of activities :

Public Administration with Scope of Formulating Policies, Plans, Projects, and Strategies for Science and Technology (S&T) Development in the Agriculture, Aquatic and Natural Resources (AANR) Sectors; Programming and Allocating Government and External Funds Generated for Research and Development (R & D) Efforts in the AANR Sectors; Monitoring R&D Projects; and Generating External Funds for its R&D Activities

Issue date : 10 December 2021
Valid until : 19 September 2024 (Subject to adherence to the agreed ongoing programme, successful endorsement of certification following each audit and compliance with the terms and conditions of certification.)
Original date of certification : 27 September 2013

Gilmore Rivera Operations Director

JAB PAB ACCREDITED QMS CERTIFICATION BODY MSA - 005

IAF

SOCOTEC Certification Philippines, Inc.
2nd Floor, JD Tower, Commerce Avenue
Madrigal Business Park
Ayala Alabang, Muntinlupa City, Philippines
http://socotec-certification-international.ph

Knowledge Management for Agriculture, Aquatic, and Natural Resources

Increase in Network Bandwidth

The need for stronger internet connection prompted the Council to increase the bandwidth of the agency's two existing service providers from 40 megabits per second (Mbps) and 90 Mbps to 120 Mbps and 150 Mbps, respectively. These improvements enabled the agency to handle the network requirements of the aforementioned online services. In addition, DOST-PCAARRD has better flexibility in switching to a more reliable network provider when a problem is encountered.

Administrative Support Information System

Human Resources Management System (HRMS). This system was conceived as an integrated and upgraded version of the existing personnel-related administrative systems such as the Computerized Attendance Monitoring System, Computerized Payroll System, and Personnel Information System. The HRMS' development has been completed with features including employee information, attendance monitoring, loan monitoring, and payroll generation. It also includes the Program to Institutionalize Meritocracy and Excellence in Human Resource Management. In addition, it aids the Council in decision-making relating to human resources because of the descriptive, predictive, and prescriptive analytics the system provides. HRMS serves as the core system that is interoperable with other administrative information system, as well as the Council's R&D information system and web services.

Customer Satisfaction Feedback Information System (CSFIS). The CSFIS was enhanced to harmonize client satisfaction feedback for both internal and external services delivered. It is already linked to the Council's major information systems and web services. It also incorporated the new service quality dimensions, which are responsiveness, reliability, access and facilities, communication, costs, integrity, assurance, and outcome, as rating criteria for client satisfaction. This consolidated client satisfaction survey is one of the eligibility criteria for the PBB grant.

R&D Information Systems

DOST-PCAARRD centered on ensuring interoperability of DPMIS with the use of the application programming interface. Through this, the existing PCAARRD R&D systems such as the Online Submission and Evaluation of R&D Proposals (OSEP), Palihan, and Human Resources Information System (HRIS), were able to successfully communicate and perform data exchanges with DPMIS.

Web Services

PCAARRD Virtual Events Site. Initially conceptualized and developed in 2020, the DOST-PCAARRD Virtual Events Site aids in the promotion and repository of all PCAARRD-led events and activities. It integrates the processes of registration, client satisfaction feedback (CSF), and the issuing of certificates for participants. In 2021, the events site was able to host 19 events across various AANR topics. It also underwent a slight enhancement to allow multiple event registrations per participant, as well as easier generation of registrant lists, registration and CSF links, and automatic emailing of certificates.

PCAARRD Advanced Learning Management System (PALMS). This service was developed to continue providing NDT courses to the NAARRDN members amid the pandemic. PALMS also permits free access to technology-based materials in agricultural resources management, crops, forestry and environment, inland aquatic resources, livestock, marine resources, technology transfer, and cross-cutting. Despite being developed earlier, the PALMS was re-launched to the public in 2021 in order to highlight and gain more interest from a wider audience set. Students and resource persons who participated in PCAARRD's NDT courses also shared their distance learning experience. The online launch was done through FB Live, and the participants were recorded through the Virtual Events Site. To date, PALMS has 70 synchronous courses and over 180 technology-based materials available.

Knowledge Management for Agriculture, Aquatic, and Natural Resources (KM4AANR). This system serves as a virtual one-stop-shop of knowledge products for PCAARRD and the regional R&D consortia. The knowledge network system integrates distributed knowledge nodes from PCAARRD databases and 16 AANR consortia databases, supporting meta-science research documentation, and real-time search and analytics engine. This 2021, the PCAARRD Knowledge Management Operational Policy was crafted to sustain the KM initiatives of the R&D consortia through the project, "Strengthening the Consortia Knowledge Network" led by Dr. Richard E. Amansec. Specifically, the policy institutionalizes KM

practices in the consortia, such as the regular audit of available and required knowledge, and the subsequent actions to develop knowledge capital. The policy also recommends systematic and organized attempts to store and use knowledge assets to raise organizational performance of the consortia members. The KM policy was further honed by the PCAARRD KM technical working group to encompass the role of the Council in the R&D Consortia scheme.

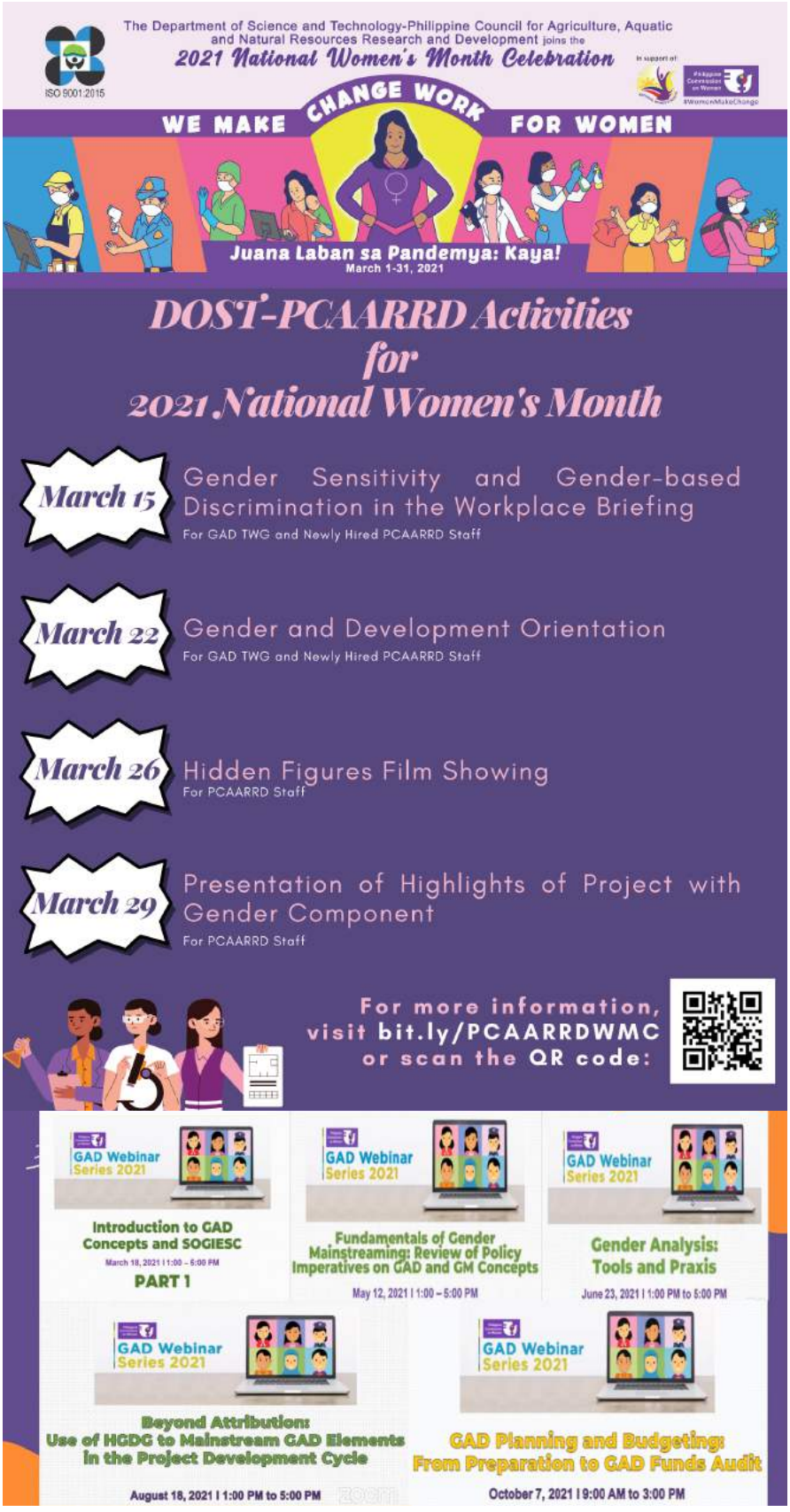
Support to Gender and Development

Increase in DOST-PCAARRD's Gender Mainstreaming Evaluation Framework Level

The Philippine Commission on Women has a Gender Mainstreaming Evaluation Framework (GMEF) that tracks the level of gender mainstreaming in a government agency. DOST-PCAARRD conducted initiatives to increase from level 2 of gender mainstreaming in 2020 to level 3 in 2021. The Council implemented policies and conducted two series of trainings for DOST-PCAARRD staff and consortia network researchers. The training's first and second phases were participated in by 127 and 87 participants, respectively. The Council also established the Committee on Decorum and Investigation and included GAD in its KM system. Overall, PCAARRD was able to attain level 3 of gender mainstreaming with a score of 71.11, which is deemed a GAD application.

Training on Basic Gender Analysis (GA) and Use of GA Tools for R&D Management and Implementation.

Training on Collection and Use of Sex-disaggregated Data (SDD) and/or Gender Statistics.



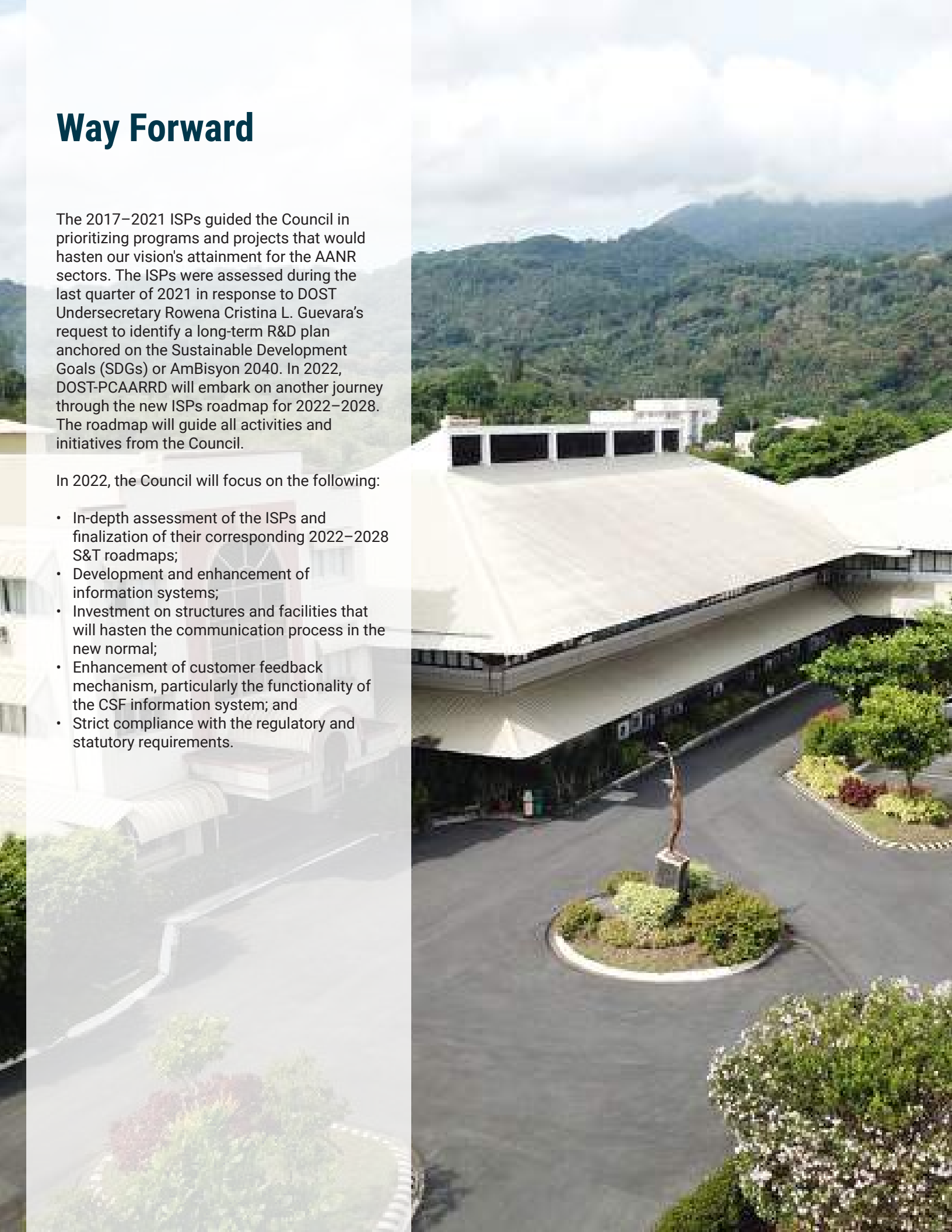
GAD trainings and activities attended by the PCAARRD GAD secretariat.

Way Forward

The 2017–2021 ISPs guided the Council in prioritizing programs and projects that would hasten our vision's attainment for the AANR sectors. The ISPs were assessed during the last quarter of 2021 in response to DOST Undersecretary Rowena Cristina L. Guevara's request to identify a long-term R&D plan anchored on the Sustainable Development Goals (SDGs) or AmBisyon 2040. In 2022, DOST-PCAARRD will embark on another journey through the new ISPs roadmap for 2022–2028. The roadmap will guide all activities and initiatives from the Council.

In 2022, the Council will focus on the following:

- In-depth assessment of the ISPs and finalization of their corresponding 2022–2028 S&T roadmaps;
- Development and enhancement of information systems;
- Investment on structures and facilities that will hasten the communication process in the new normal;
- Enhancement of customer feedback mechanism, particularly the functionality of the CSF information system; and
- Strict compliance with the regulatory and statutory requirements.



List of Acronyms

AABH	Agri-Aqua Business Hub
AANR	agriculture, aquatic, and natural resources
ACE	Applied Communication Expert
ADAP	Accelerating Diagnostic Access Project
AHPND	Acute hepatopancreatic necrosis disease
AMTEC	Agricultural Machinery Testing and Evaluation Center
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARMRD	Agricultural Resources Management Research Division
ARS	Applied Rural Sociology
ASEAN	Association of Southeast Asian Nations
ASEAN-NDI	ASEAN Network for Drugs, Diagnostics, Vaccines, and Traditional Medicines Innovation
ASF	African Swine Fever
ASTIF	ASEAN Science, Technology and Innovation Fund
ATBI	Agri-Aqua Technology Business Incubator
AV	audio visual
BAC	Business Advisory Council
BAI	Bureau of Animal Industry
BANDALA	Backcross Abaca with Native and Desirable Accessions to Lift up the Abaca industry
BatSU	Batangas State University
BAYT	Baybay Tall
BFAR	Bureau of Food and Agricultural Research
BFT	biofloc technology
BIOMECH	Center for Agri-fisheries and Biosystems
BIST	Business Innovation through S&T for Industry
BPI-LBNCRDPSC	Bureau of Plant Industry-Los Baños National Crop Research, Development and Production Support Center
BPI-NSQCS	Bureau of Plant Industry-National Seed Quality Control Services
BSU	Benguet State University
BUCOR	Bureau of Corrections
CBSUA	Central Bicol State University of Agriculture
CLA	CropLife Asia
CLSU	Central Luzon State University
CMI	Consortia Member Institutions
CMU	Central Mindanao University
COA	Council of Agriculture
CorPlan	corporate plan
CoSAI	Commission on Sustainable Agricultural Intensification
COSTI	Committee on Science, Technology, and Innovation
COVID-19	Coronavirus disease
CPD	Continuing Professional Development

CPGP	Carrageenan plant growth promoter
CPM	clean planting material
CRADLE	Collaborative Research and Development to Leverage Philippine Economy
CRD	Crops Research Division
CSC	Civil Service Commission
CSFIS	Customer Satisfaction Feedback Information System
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CvSU	Cavite State University
DENR-ERDB	Department of Environment and Natural Resources-Ecosystems Research and Development Bureau
DLSU	De La Salle University
DMMMSU	Don Mariano Marcos Memorial State University
DNA	deoxyribonucleic acid
DOST	Department of Science and Technology
DPGAA	DOST-PCAARRD Graduate Alumni Association
DPITC	DOST-PCAARRD Technology and Innovation Center
DPMIS	DOST Project Management Information System
EPP	enriched potting preparation
FB	Facebook
FERD	Forestry and Environment Research Division
FFTC	Fertilizer Technology Center for the Asian and Pacific Region
FIESTA	Farms and Industry Encounters through the S&T Agenda
FLS-HGEM	Farmer Livestock School on Halal Goat Enterprise Management
FOI	Freedom of Information
FPRDI	Forest Products Research and Development Institute
FSII	Federation of Seed Industry of India
GAD	Gender and Development
GALING	Good Agri-Aqua Livelihood Initiatives towards National Goals
GDD	growing degree days
GFAR	Global Forum on Agricultural Research and Innovation
GIA	Grants-in-Aid
GIS	geographic information system
GMEF	Gender Mainstreaming Evaluation Framework
GPS	global positioning system
GREAT	Graduate Research and Education Assistantship for Technology
HATID ASEAN	Health Technologies for Informed Decision-making in the Association of Southeast Asian Nations
hd	head
HIIGIT ASEAN	Health Information Infrastructure, Governance, and Incipient Technologies in the ASEAN Region
HIRAyA	Harmonizing Initiatives for R&D Advocacy in AANR
HNRDA	Harmonized National Research and Development Agenda
HRIS	Human Resources Information System
HRMS	Human Resources Management System

ICOS	Institutional Contract of Service
ICS	Institute of Crop Science
IEC	information, education, and communication
IfSU	Ifugao State University
IP	intellectual property
IPM	integrated pest management
IPTBM	Intellectual Property and Technology Business Management
ISAT-U	Iloilo Science and Technology University
ISM	Integrated Social Marketing
ITRI	Industrial Technology Research Institute
JAF	Jiangxi Academy of Forestry
JAmp-	Juan Amplification
JCMST	Joint Commission Meeting on Science and Technology
JDF	John Dillon Fellowship
JIRCAS	Japan International Research Center for Agricultural Sciences
JSPS	Japan Society for the Promotion of Science
JSTC	Joint Science and Technology Commission
JxAAS	Jiangxi Academy of Agricultural Sciences
KM4AANR	Knowledge Management for Agriculture, Aquatic, and Natural Resources
LAGT	Laguna Tall
LAMP	loop mediated amplification
LARC	LWD Aquatic Resources Corporation
LBSCFI	Los Baños Science Community Foundation, Inc.
LGU	local government unit
LIFE	Livelihood Improvement through Facilitated Extension
LingAP	Lingkod Alalay sa Pamayanan
LSHTM	London School of Hygiene and Tropical Medicine
MC	moisture content
MECO-TECO JRP	Manila Economic and Cultural Office-Taipei Economic and Cultural Office Joint Research Project
MIMAROPA	Mindoro, Marinduque, Romblon, Palawan
MinSU	Mindoro State University
MMSU	Mariano Marcos State University
MOU	Memorandum of Understanding
MRD	Malayan Red Dwarf (MRD)
MS	Master of Science
MSME	micro, small and medium enterprises
MSU	Michigan State University
MSU-TCTO	Mindanao State University - Tawi-Tawi College of Technology and Oceanography
NAARRDN	National Agriculture, Aquatic and Natural Resources Research and Development Network
NBP	New Bilibid Prison
NCR	National Capital Region
NGO	non-government organization
NICER	Niche Centers in the Regions

NM	nutrient management
NPK	nitrogen (N), phosphorus (P) and potassium (K)
NRDC	National R&D Conference
NSPRDC	National Swine and Poultry Research and Development Center
NSTW	National Science & Technology Week
NTIFO	National Training Institute for Farmers' Organization
OIC	officer-in-charge
OSEP	Online Submission and Evaluation of R&D Proposals
PAA	Policy Analysis and Advocacy
PAC	Policy Advisory Council
PALMS	PCAARRD Advanced Learning Management System
PBB	performance-based bonus
PCAMRD	Philippine Council for Aquatic and Marine Research and Development
PCAR	Philippine Council for Agricultural Research
PCARRD	Philippine Council for Agriculture and Resources Research and Development
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development
PCAARRD	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
PCMD	Policy Coordination and Monitoring Division
PDL	persons deprived of liberty
PGC	Philippine Genome Center
PhD	Doctor of Philosophy
PhilRice	Philippine Rice Research Institute
PPE	Personal protective equipment
PRC	Professional Regulation Commission
PSAU	Pampanga State Agricultural University
PSU-MSL	Palawan State University-Marine Science Laboratory
PTRI	Philippine Textile Research Institute
PUP	Polytechnic University of the Philippines
QMS	Quality Management System
QP	queen pineapple
R&D	research and development
ReAARRC	Rebuilding the Agriculture, Aquatic and Natural Resources in Response to COVID-19
rRNA	ribosomal ribonucleic acid
S&T	Science and technology
SCB	sub-committee on biotechnology
SciCAT	Science for the Convergence of Agriculture and Tourism
SEAMEO-SEARCA	Southeast Asian Ministers of Education Organization-Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SERD	Socio-Economics Research Division
SKSU	Sultan Kudarat State University
SLIMS	Science Library Integrated Management System
SMAARRDEC	Southern Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium

SOXAARRDEC	SOCCSKSARGEN Agriculture, Aquatic and Natural Resources Research and Development Consortium
SP	sweetpotato
SSU	Samar State University
SUCs	State Universities and Colleges
TAC	Technical Advisory Committee
TACD	Tacunan Green Dwarf
TAGT	Tagnanan Tall
TBI	Technology Business Incubator
TRD	technical research division
UN	United Nations
UNE	University of New England
UP-MSI	University of the Philippines-Marine Science Institute
UPLB-LS	University of the Philippines Los Baños-Limnological Station
UPLGRTS	UP La Granja Research and Training Station
UPV-NIMBB	University of the Philippines Visayas-National Institute of Molecular Biology and Biotechnology
USA	United States of America
USDA	United States Department of Agriculture
USeP	University of Southeastern Philippines
USM	University of Southern Mindanao
VICARP	Visayas Consortium for Agriculture, Aquatic and Natural Resources Program
w	watt
WMSU	Western Mindanao State University
WPU	Western Philippines University
ZamPen	Zamboanga Peninsula

Appendices

GOVERNING COUNCIL, CY 2021

Secretary Fortunato T. de la Peña (Chair)
Department of Science and Technology

Dr. Rowena Cristina L. Guevara (Alternate)
Undersecretary for Research and Development
Department of Science and Technology

Hon. William D. Dar (Vice-Chair)
Secretary
Department of Agriculture

Usec. Rodolfo V. Vicerra (Alternate)
Undersecretary for DA Attached Agencies
Department of Agriculture

Hon. Roy A. Cimatu (Co-Vice-Chair)
Secretary
Department of Environment and Natural Resources

Dr. Henry Adornado
Director
Ecosystems Research and Development Bureau

Hon. Ramon M. Lopez (Member)
Secretary
Department of Trade and Industry (DTI)

Ms. Raquel B. Echague
Director
DTI, Industry Studies Department

Dr. Reynaldo V. Ebora (Secretary)
Executive Director
Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
Department of Science and Technology

Dr. Jose V. Camacho, Jr.
Chancellor
University of the Philippines Los Baños

Dr. Clement C. Camposano(Member-Academe)
Chancellor
University of the Philippines Visayas

Mr. Jose P. Leviste, Jr. (Member-Private Sector)
Chairman
Oceanagold (Phils.), Inc.

Mr. Phillip L. Ong (Member-Private Sector)
President
Santeh Feeds Corporation

Engr. Augusto C. Natividad (Member-Private Sector)
Senior Vice President
Frabelle Fishing Corporation

Mr. Arsenio Go Barcelona (Member-Private Sector)
President
Harbest Agribusiness Corporation

PCAARRD DIRECTORS' COUNCIL, CY 2021

Dr. Reynaldo V. Ebora
Office of the Executive Director (OED)

Dr. Melvin B. Carlos
OED-Administration, Resource Management and Support Services (ARMSS)

Dr. Feliciano G. Calora, Jr.
OED-Research and Development (RD)

Ms. Marita A. Carlos
Applied Communication Division (ACD)

Dr. Juanito T. Batalon
Agricultural Resources Management Research Division (ARMRD)

Dr. Edna A. Anit
Crops Research Division (CRD)
(January 1–May 13)

Dr. Allan B. Siano
OIC-CRD
(May 14–December 31)

Ms. Susan S. Molina
Finance and Administrative Division (FAD)

Dr. Leila C. America
Forestry and Environment Research Division (FERD)
(January 1–September 15)

For. Faustina C. Baradas
OIC-FERD
(September 16–December 31)

Engr. Eduardo V. Manalili
Inland Aquatic Resources
Research Division (IARRD)
(January 1–June 22)

Dr. Adelaida T. Calpe
OIC-IARRD
(June 23–December 31)

Dr. Fezoil Luz C. Decena
Institution Development Division
(IDD)

Dr. Synan S. Baguio
Livestock Research Division (LRD)

Dr. Richard E. Amansec
Management Information
Systems Division (MISD)

Dr. Mari-Ann M. Acedera
Marine Resources Research
Division (MRRD)

Dr. Lilian G. Bondoc
Policy Coordination
and Monitoring Division (PCMD)

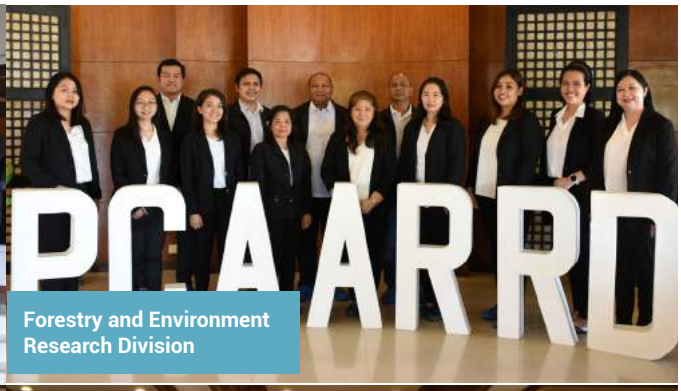
Dr. Ernesto O. Brown
Socio-Economics Research Division
(SERD)

Mr. Noel A. Catibog
Technology Transfer
and Promotion Division (TTPD)

Ms. Sharie Al-Faiha A. Lubang
PCAARRD Employees Association
(PCAARRDEA)

DOST-PCAARRD STAFF, CY 2021


Applied Communication Division



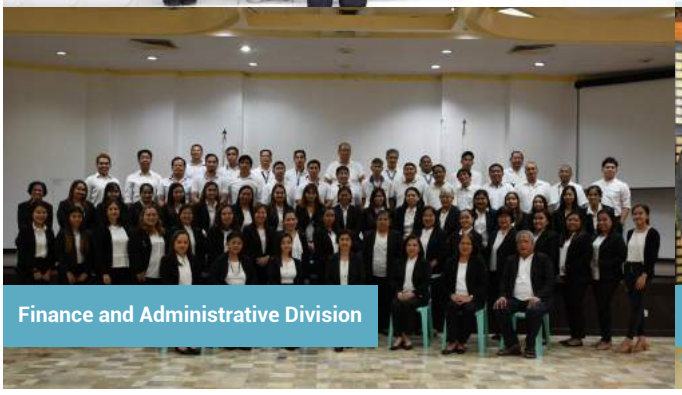
Forestry and Environment Research Division


Agricultural Resources Management Research Division

Inland Aquatic Resources Research Division


Crops Research Division


Institution Development Division


Finance and Administrative Division

Livestock Research Division


Management Information Systems Division


Policy Coordination and Monitoring Division


Marine Resources Research Division


Socio-Economics Research Division


Office of the Executive Director


Technology Transfer and Promotion Division


Office of the Executive Director-Administration, Resource Management and Support Services


Office of the Executive Director-Research and Development

RRDCC CHAIRPERSONS AND CONSORTIUM DIRECTORS, CY 2021

Region/Consortium Base Agency	RRDCC Chairpersons	Consortium Directors
CAR – CorCAARRD (Cordillera Consortium for Agriculture, Aquatic and Resources Research and Development) Benguet State University (BSU)	 **Dr. Felipe Salaing Comila** President Benguet State University (BSU)	 **Dr. Ruth S. Batani** Vice President (VP) for Research and Extension, BSU
Region I – ILAARRDEC Ilocos Agriculture, Aquatic and Natural Resources Research and Development Consortium Mariano Marcos State University (MMSU)	 **Dr. Shirley C. Agrupis** President, MMSU	 **Dr. Epifania O. Agustin** Executive Assistant IV, MMSU
Region II – CVAARRD Cagayan Valley Agriculture, Aquatic and Natural Resources Research and Development Consortium Isabela State University (ISU)	 **Dr. Ricmar P. Aquino** President, ISU	 **Dr. Miladis M. Afidchao** Professor V, ISU
Region III – CLAARRDEC Central Luzon Agriculture, Aquatic and Natural Resources Research and Development Consortium Central Luzon State University (CLSU)	 **Dr. Honorio M. Soriano, Jr.** President, Pampanga State Agricultural University (PSAU) (January 1–July 19)	 **Dr. Fe L. Porciuncula** VP for Research, Extension and Training (RET), CLSU (January 1–July 21)
	 **Dr. Gregorio J. Rodis** President, Bataan Peninsula State University OIC, RRDCC Chair (July 20–November 8) RRDCC Chair (November 9–December 31)	 **Dr. Maria Excelsis M. Orden** OIC, Consortium Director Research Center Director CLSU (July 22–December 31)

Region IV-A – STAARRDEC
Southern Tagalog Agriculture, Aquatic and Resources Research, Development and Extension Consortium

Cavite State University (CvSU)

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President, CvSU

Dr. Marilyn M. Escobar
Dean, CvSU
(January 1–September 14)

Dr. Almira G. Magcawas
OIC, Consortium Director
Director of Extension Services
CvSU
(September 15–December 31)

Region IV-B – MAARRDEC
MIMAROPA Agriculture, Aquatic and Natural Resources Research and Development Consortium

Mindoro State College of Agriculture and Technology (MinSCAT)

Dr. Levy B. Arago, Jr.
President, MinSCAT

Dr. Maria Concepcion L. Mores
Vice President for Research, Development and Extension, MinSCAT
(January 1–31)

Dr. Christian Anthony C. Agutaya
Vice President for Research, Extension and Development
(February 1–December 31)

Region V – BCAARRD
Bicol Consortium for Agriculture, Aquatic and Natural Resources Research and Development

Bicol University-College of Agriculture and Forestry (BUCAF)

Dr. Arnulfo M. Mascariñas
President, Bicol University

Dr. Marissa N. Estrella
Professor, BUCAF

Region VI – WESVAARRDEC Western Visayas Agriculture, Aquatic and Natural Resources Research and Development Consortium West Visayas State University (WVSU)	 **Dr. Raul F. Muyong** President, Iloilo Science and Technology University (ISAT-U)	 **Dr. Pastor Jones T. Denusta** Associate Professor, VSU
Region VII – CVAARRDEC Central Visayas Agriculture, Aquatic and Natural Resources Research and Development Consortium Bohol Island State University (BISU)	 **Dr. Regucivilla A. Pobar** President, BISU	 **Dr. Zina D. Sayson** VP for Research Development and Extension, BISU
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Region IX – WESMAARRDEC Western Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium Western Mindanao State University (WMSU)	 **Dr. Ma. Carla A. Ochotorena** President, WMSU	 **Dr. Teresita A. Narvaez** Vice President for Research Extension Services & External Linkages, WMSU
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Region XI – SMAARRDEC Southern Mindanao Agriculture, Aquatic and Natural Resources Research and Development Consortium University of Southeastern Philippines (USeP)	 **Dr. Lourdes C. Generalao** President USeP	 **Dr. Gilbert A. Importante** Dean, College of Applied Economics USeP
Region XII – SOXAARRDEC (SOCCSKSARGEN Agriculture, Aquatic and Natural Resources Research and Development Consortium) formerly CAARRDEC University of Southern Mindanao (USM)	 **Dr. Rolando F. Hechanova** President, Sultan Kudarat State University (SKSU) (January 1–March 5)	 **Dr. Elizabeth C. Molina** Professor VI, USM (January 1–July 31)
	 **Dr. Sailila E. Abdula** Center Director PhilRice-Midsayap Experimental Station (March 6–December 31)	 **Dr. Josephine R. Migalbin** Professor VI, USM (August 1–December 31)
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The PCAARRD Logo

The basic figure in DOST-PCAARRD's logo is from its mother agency's (the Department of Science and Technology) logo, which consists of four circles joined together side by side to form a square. The circles symbolize unit particles, the building blocks of nature which are the subject and substance of science and technology. The circle design represents movement signifying progress through science and technology (S&T).

The center square represents DOST-PCAARRD and is composed of a human figure carrying an oversized headgear or 'salakot.' The human figure with extended arms represents the research and development (R&D) community fused into a world-class research enterprise working towards enhancing productivity, innovative capacity, and global competitiveness in agriculture, aquatic, and natural resources (AANR) sectors.

The salakot, a traditional Filipino wide-brimmed hat depicts the Council's commitment to protect and improve the lives and well-being of the common farmers and fisherfolk by enabling the national agriculture, aquatic, and resources research and development system (NAARRDS) to respond to the challenges and impact of a constantly changing environment.

The brims in the salakot symbolize the joint efforts and collaborative S&T interventions for the AANR sectors. The upper green brim depicts the agriculture and natural resources while the lower blue brim represents the aquatic and marine resources sectors, which all require sustainable use and management.

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